ENGINEERING NEWS

AND

AMERICAN RAILWAY JOURNAL.

Vol. XXXII, No. 25.

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A test of the strength of a 3-in. concrete floor reinforced by a sheet of expanded metal embedded in it and hooked over the beams was made Dec. 15 by the Expanded Metal Fireproof Construction Co., of New York, in the new Salvation Army Building on East 14th St., New York. The floor is flat, but reinforced at intervals of about 5 ft. by channel iron arches (laid with the flat side underneath) resting upon the lower flanges of the floor beams. The channel is filled with concrete and the haunches of its arch filled in with concrete to the floor level. On a section of floor, midway between the arches and beams, 12 ins. square, a load of 3,800 lbs. of pig iron was piled without causing deflection or fracture, the test being discontinued on account of the falling over of the pile of pig iron. The expanded metal, as illustrated in our issue of Dec. 7, 1889, consists of a sheet of soft steel slashed and opened out forming a sort of net with thin, deep meshes on edge.

The sinking of made land at Tacoma, Wash., noted in our issue of Dec. 6, seems to have had a deeper source than the effect of heavy rains, the cause ascribed at the time. Chief Engineer McHenry, of the Northern Pacific R. R., has been comparing soundings made before and since the accident. Enough data have been secured to show that the center of disturbance was at least 100 ft. below the bottom of the Sound at this point, and probably 1,000 ft. out from the shore; and that the subsidence was much greater in area than was originally supposed. The sinking was vertical, and not simply a slide; and the weight of the made land figured as a very small factor in the final result. The investigation has also demonstrated the fact that improvements on the water front in this vicinity must be somewhat changed in their character from the plans originally adopted.

Whether to open the emergency valve or the air signal, in case of accident while a train is running, is a question on which opinions are likely to differ, and which is not likely to be settled satisfactorily for some time to come. On the Boston & Maine recently the axle of a parlor car broke when the train was running, near Wells, Me., at about 20 miles an hour. Hon. B. F. Chadbourne, of the Maine Railroad Commission, was a passenger in the car and stopped the conductor from pulling the brake valve, telling him to pull the air signal instead. He obeyed, and the train came to an easy stop, with the derailment of only two trucks. We take the above from a newspaper report, which bestows great credit on the Commissioner for his presence of mind. Whether the report be true or not, it opens an interesting question as to what to do in an emergency on board a train.

Secretary of War Lamont has declined to approve the plans of the New York and New Jersey Bridge Co. for a 2,000-ft. cantilever span across the Hudson at New York, this plan including a mid-stream pier. Mr. Lamont bases his decision upon the report of the board of five expert engineers of last September. He says that these experts find that both a 2,000-ft. cantilever bridge, requiring a pier in the river, and a 3,100-ft. span suspension bridge, without a center pier, are safe and not impracticable as to cost, and that the time required for construction is practically the same in both cases. He quotes the estimates for these two bridges, and concludes as follows:

> In view, therefore, of these facts and findings, as of the very serious objections to a pier in the harbor, with its attendant delay and constant menace to navigation, I am constrained to require that the bridge to be built by the New York and New Jersey Bridge Co. across the Hudson River shall have a single span between the pier lines of the New York harbor.

While I do not undertake to say that the objection of an obstruction in the harbor is sufficiently grave to prohibit the construction of a pier bridge, were a suspension bridge impracticable, it is a matter for public congratulation that a scientific investigation of the subject by skilled and experienced engineers determines that both the traffic on the river, as well as that over it, can be accommodated without interference, and the rights of all protected, with only such an increase of expense, if any, as is clearly demanded by the conceded advantages to follow.

A report on street-car fenders has recently been made to the Commissioners of the District of Columbia by Mr. L. P. Bradshaw. The fenders reported on were the Smith, Parmenter, Sterling, Russ, Hurst, Crawford, Blackistone, Stiefel and Polle. Each one of these is criticised more or less severely in the report. It is stated that the Commissioners are likely to soon order the equipment of all cars with fenders.

The Maritime Canal Company, holding the concessions for building the Nicaragua Canal, has made its annual report to the Secretary of the Interior, in accordance with the requirements of an act of Congress. The report states that the Maritime Canal Company was organized in 1889, and since that time 10,144 shares of its capital stock, of the nominal value of $10,014,500, have been subscribed for, with $1,007,840 paid in in cash. From other sources the treasury of the company has received $62,117, making a total of $1,069,957. The expenditures for administration purposes have been $844,882.63. It issued 180,000 shares of its capital stock, at the par value of $18,000,000, in payment for concessionary rights, privileges, franchises and other property. The liabilities of the company are $6,855,000, and cash liabilities not exceeding $50,000. They report no material advance in construction work since December, 1892, but they hope for a vigorous prosecution of the work in the future.

No very serious railway accidents have been recorded during the past week, the worst having been caused by wreckers on the Lehigh Valley R. R., Dec. 18, at Horton, Pa., who opened a switch and sent an express train onto a side track, smashing several coal cars. Nobody was hurt.

The Chicago cable car collision reported last week is being investigated, especially as to the failure of the brakes after the grip broke. There is a rule that conductors must stop taking fares and stand by the brakes when the trains are on the steep grades of the tunnel approaches, but it is said this rule is constantly broken, and was in fact broken by two conductors on the runaway train.——A similar accident occurred in the Van Buren St. tunnel Dec. 13, the grip failing on a train which was ascending the grade, and the train running back against the next one, but fortunately the trains were close together and nobody was injured, though the car platform was smashed and the passengers were thrown down by the shock.

A car on the Broadway cable road, New York, struck a horse-car which was crossing the cable track at 42d St., on Dec. 15. The horse-car was struck squarely on the side and thrown nearly 7 ft. from the track. Several passengers were cut and bruised, but none seriously injured.

A boiler explosion occurred Dec. 11 at the Vincennes Novelty Works, Vincennes, Ind., one person being seriously injured by flying material.——A boiler explosion in Russell Bros. box factory at West Bay City, Mich., occurred Dec. 18, by which five men were killed and two injured.

A large masonry dam is to be built at Holyoke, Mass., by the Holyoke Water & Power Co. The foundations for the structure have been under way for some time, and bids for building the dam proper, it is said, will be received until Feb. 15. It is reported that the dam will be 1,020 ft. long, and in general 30 ft. high above the river bed, though in one or two places its height will be 40 ft. The abutments will extend 12 ft. above the main dam. The estimated quantities in the dam are given as follows: Rubble stone masonry, 34,500 cu. yds.; granite dimension, 11,125 cu. yds.; split granite in back of dam, 2,500 cu. yds.; making a total of 48,125 cu. yds. of masonry. The dam will be located some 180 ft. below the old timber dam built in 1849, which has recently caused much trouble by leakage.

Two large car transfer boats are to be built for the Pittsburg, Shenango & Lake Erie R. R. by the Craig Shipbuilding Co., of Toledo, O., to carry coal cars across Lake Erie between Conneaut, O., and Port Dover, Ont., thus saving the long railway haul by way of Buffalo and Suspension Bridge. Each boat will have capacity for 24 cars and will cost about $200,000. They are to have ice-breaking bows so that traffic will not be interfered with in the winter. The boats will be very similar to those built by the same company for the Lake Michigan service of the Toledo, Ann Arbor & North Michigan Ry., which were described and illustrated in our issue of June 15, 1893.

The Lachmann electrical conduit system for electric railways has been adopted by Siemens & Halske, of Berlin, according to the "Elektricher Anzeiger." This system is similar to the Barkley system, invented by Mr. R. W. Barkley, Temple Court, New York city, and illustrated and described in our issue of Oct. 20, 1892. The special feature is the exclusion of water from the wire conduit in case of its flooding by carrying the wire in an inverted trough in which the air is sealed as the water rises, on the same principle as a diving bell.

The Berliner telephone patent No. 463,569, issued Nov. 17, 1891, to Emil Berliner, and assigned to the Bell Telephone Co., was declared void by Judge Carpenter of the U. S. Circuit Court on Dec. 18. This is the case brought by the government, and is, we believe, the first case on record in which a patent has been annulled by a suit brought by the government. The case will be carried to the Court of Appeals.

The new Delaware River bridge which is to be built by the Pennsylvania R. R. at Philadelphia, is to have three 540-ft. spans and a 330-ft. draw span. Besides these spans there will be approaches of considerable length on each side of the river. The contract for the substructure is to be let on Dec. 28, according to press reports.

The Harlem Ship Canal is to be opened to traffic in April next, and plans have been prepared by the Department of Docks of New York city for the improvement of the south side of the Harlem River by the construction of docks and wharfs at an estimated cost of $2,472,100.

Excess speed premiums for new war-ships will probably call for some action from Congress in the line of abolishing, or at least, much reducing them. Secretary Herbert and Chief Naval Constructor Hichborn both recommend the construction by the government of an apparatus for testing the probable speed of vessels to be constructed by towing models, on the methods now followed by foreign governments. Such an apparatus would cost about $35,000, and from the records thus obtained in an experimental tank, the stability, speed and lines of the ship proposed can be determined with great accuracy.

The output of the Watervliet Arsenal for the last fiscal year was eleven 8-in. guns, eleven 10-in. guns, six 12-in. guns and one 10-in. Crozier wire-wound gun. Work upon seven 12-in. mortars is also well progressed. The future output is placed at forty-two 8, 10 and 12-in. guns per year, besides 50 field pieces. This arsenal is devoted to the manufacture of sea-coast guns, and has a complete plant for making guns up to and including 12-in. caliber, and contracts have been concluded for the tools needed for 16-in. guns. The lacking feature is a proving ground, as all guns are now sent to Sandy Hook for this purpose. The cost of such a ground near West Troy, with all its butts, railway tracks, etc., is estimated at $98,840, and it is believed that this outlay would soon be offset by the saving in transportation. The arsenal at Watertown provides heavy gun-carriages of all types, and that at Rock Island turns out machine gun and field-gun carriages, with the battery wagons, forges, etc. At the Springfield Arsenal are being made the new army magazine rifle, at the rate of 80 per day. Frankford Arsenal, near Philadelphia, manufactures ammunition for small arms, shrapnel for field guns, fuses, gun-sights, etc. It makes 8,000 per day of the cartridges for the new .30-in. caliber rifle; but during the last year that arsenal also turned out 2,537,000 cartridges for the .45-in. caliber rifles and carbines, and 2,750,000 cartridges for the .38-in. caliber revolvers.

THE CALCULATION OF HIP AND VALLEY ANGLES IN ROOF WORK.*

By C. A. P. Turner, C. E.

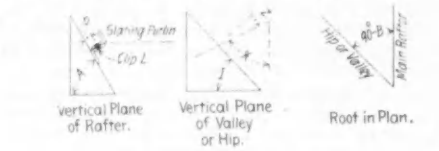
The determination of the various bevel angles in hip and valley roof work with normal purlins, although a simple process, is not generally well understood by draftsmen. In shops where little of this work has to be done it is often left to the templet men know more than the draftsmen. templet men know more than the draughtsmen. Again, draftsmen who have more occasion to do this class of work are not always familiar with the simplest methods. For example, the angles I and P in the notation given below may be calculated, and the other angles worked out graphically. The objection to this method is that besides taking much more time, the angles cannot be determined as accurately as they can be with a common slide rule. Indeed, where the roof planes have the same inclination and the angle at the eaves is 90°, very little computation is necessary, as will be seen from equations 2a, 3a, 4a and 7a, given below.

While in the employ of the Pittsburg Bridge Co. the writer worked out a series of formulas for calculating hip and valley angles, which he has since used with satisfaction. They are practical, and as there seems to be little or nothing in print which touches upon this class of work, they may be found useful to other designers. The formulas for skew portal angles are simply another development of the same problem.

In working with these formulas the following notation is used:

Let A = the angle between the plane of the roof and the horizontal plane.

B = the angle between the lines out from a horizontal plane (1) by the plane of web of hip, and (2) by the roof plane.



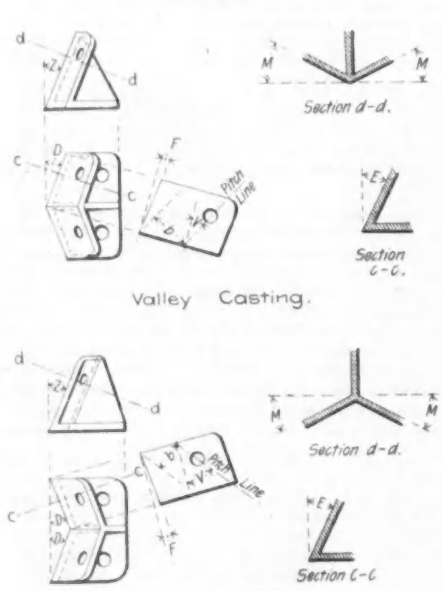


Fig. 2. Cast Iron Hip and Valley Angle Connections for Roof of Vanderbilt Chateau.

I = the angle made by the hip rafter with the horizontal plane.

P = the angle in the plane of roof between a main and a hip or valley rafter.

X = the angle between (1) the intersection line of plane of web of purlin and plane of web of hip, and (2) a vertical line in plane of web of hip.

G = the angle between the roof plane and the plane of back of hip rafter.

V = the angle in the plane of web of purlin between a normal to the center line of purlin and the line cut from plane of web of purlin by plane of web of hip.

M = the amount the angle between the plane of web of purlin and the plane of web of hip differs from 90°.

D = the angle between (1) the line cut out of the plane of the back of hip by the plane of web of purlin, and (2) a line normal to plane of web of hip and in the plane of back of hip.

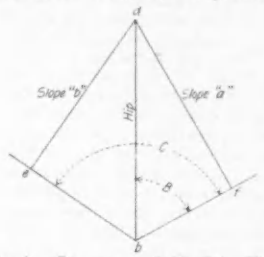


Fig. 1. Diagram of Roof in Plan.

E = the amount the angle between the plane of web of purlin and plane of back of hip rafter differs from 90°.

F = the amount the angle between (1) the line of intersection of the plane of web of hip with plane of web of purlin, and (2) the line of intersection of plane of web of purlin with plane of back of hip rafter differs from 90°

Thus:

$$\text{Tan I} = \tan A \sin B. \quad (1)$$

$$\text{Tan P} = \tan (90° - B) \cos A.$$

$$\text{Tan V} = \sin A \div \tan B = \sin A \cot B. \quad (3)$$

$$\text{Tan G} = \sin I \div \tan B = \sin I \cot B. \quad (4)$$

$$\text{Tan X} = \tan A \div \sin B \text{ or } \cot X = \cot A \sin B. \quad (5)$$

$$Z = X - I;\ \sin Z = \sin P \sin V. \quad (6)$$

$$\text{Tan M} = \tan P \cos V = \cot B \cos X. \quad (7)$$

$$\text{Tan D} = \tan M \div \cos Z;\ \cot D = \cot M \cos Z \quad (8)$$

$$\text{Tan E} = \tan Z \cos D. \quad (9)$$

$$\text{Sin F} = \sin D \sin Z. \quad (10)$$

When the two roof planes forming the hip or valley have the same slopes, and their lines of intersection with a horizontal plane form an angle of 90°, B will equal 45° and tan. B equal unity. Equations (2), (3), (4) and (7) will then reduce to the following forms:

$$\text{Tan P} = \cos A. \quad (2a)$$

$$\text{Tan V} = \sin A. \quad (3a)$$

$$\text{Tan G} = \sin I. \quad (4a)$$

$$\text{Tan M} = \cos X. \quad (7a)$$

Now, when the two roof planes do not have the same slope, or when they not only have different slopes, but their lines of intersection with a horizontal plane form any angle differing from 90° (which may be called C), before we can apply the foregoing formulas it is necessary to determine the angle B. Therefore, having given the slope angles a and b of the two respective roof-planes with the horizon, and the angle C, to find angle B, take any point, d, Fig. 1, on the hip at an elevation, h, above the horizontal plane e b f, and draw e d perpendicular to e b, and d f perpendicular to b f. Then

$$\frac{\frac{h}{(\tan a)}}{\sin B} = \frac{\frac{h}{(\tan b)}}{\sin (C - B)}$$

which reduces to,

$$\text{Cot B} = \frac{\tan b + \cos C \tan a}{\tan a \sin C.} = \cot C + \frac{\tan b.}{\tan a \sin C} \quad (11)$$

Now, using B as determined, we can find all the angles for slope a by formulas (1) to (10). For slope b substitute b for A and (C-B) for B in formulas (1) to (10) and all angles required may be computed. As the angle I is common to both sets of angles, equation (1) should give the same result in figuring for slopes a and b.

When C = 90°, and a = b, $\frac{\tan b + \cos C \tan a}{\tan a \sin C} = 1$, or B = 45°.

When slope a equals slope b, $\cot B = \frac{1 + \cos C}{\sin C} = \cot \frac{1}{2} C$, or $B = \frac{1}{2} C$.

When C = 90° and a and b are unequal we have

$$\cot B = \frac{\tan b}{\tan a}$$

Where the two roof planes forming a hip or valley have the same inclination and C = 90° it will be seen by inspection of equations (2a), (3a), (4a) and (7a) that G, V, M and P are always less than 45°. G and V increase and M and P decrease as A increases. Z is greatest for any value of B when A = 45° and decreases the same amount for an equal increase or decrease from 45° in the value of a, approaching zero as a approaches zero or 90°. A clear understanding of the limiting values of the bevel angles and the way in which they vary will be found of no little value in detecting errors in the work. Where B does not equal 45° it will be found better to compute Z by the equation sin Z = sin P. sin V, and then we need not compute X.

The equations are given in two forms, so that if using the slide rule, it will not be necessary to bother with the cotangents of some of the angles, while, if not, it is easier to multiply than divide. Other equations may be given covering the same angles, but too many would be confusing, while those which determine the angle in terms of the sine or cosine are not as valuable as those which determine the angle in terms of the tangent or cotangent. Equation (11) must be applied with the following caution: When C is greater than 90°, cosine C is negative and cot B = the numerical difference between cot C and,

$$\left(\frac{\tan b}{\tan a \sin C}\right)$$

Where it is necessary to make a layout for clearance, the work is materially lessened if we have only to lay the bevel angles out from their tangents.

In figuring main distances such as lengths of purlins, jack rafters, etc., and their intersections on the hip and valley rafters, it is generally best to figure these distances in the same plane and afterwards reduce them to the plane in which they are wanted. Too much care cannot be exercised in getting the main dimensions correct, as upon them depends the whole value of the work. The surest and best way to determine them correctly is to figure every dimension by two entirely independent methods, and then, if the same result is obtained,

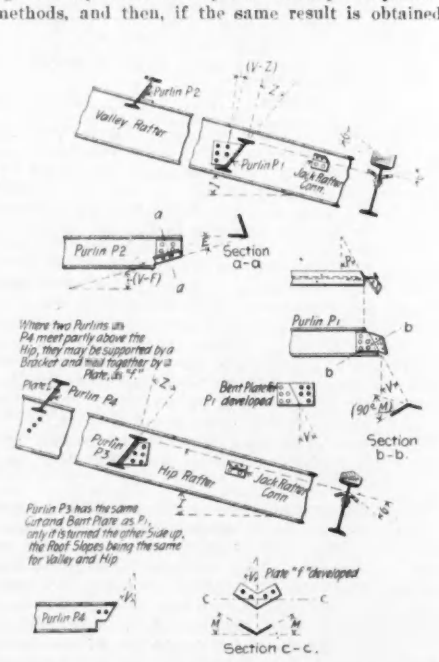

Valley Rafter
Purlin P2
Purlin P1
Jack Rafter Conn.
Section a-a
Where two Purlins as P4 meet partly above the Hip, they may be supported by a Bracket and rivd together by a Plate, as "f"
Purlin P4
Plate "f"
Bent Plate for P1 developed
Purlin P3
Hip Rafter
Jack Rafter Conn
Section b-b.
Purlin P3 has the same Cut and Bent Plate as P1, only it is turned the other Side up, the Roof Slopes being the same for Valley and Hip
Plate "f" developed
Purlin P4
Section c-c.

Fig. 3. Hip and Valley Angle Connections for Roof of Carnegie Library, Pittsburg, Pa.

they are most probably correct. The plane in which the main dimensions are first figured may be termed the reference plane and should be selected so that there will be the least possible work in the reduction of the distances determined in it.

The two plates of connections, Figs. 2 and 3, figured according to the formulas, will aid in their explanation. Fig. 2 shows the hip and valley connections of the 1½ × 1½-in. slating angles used on the roof of the Vanderbilt Chateau at Biltmore, N. C., and Fig. 3 shows some of the details in the

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roof of the Carnegie Library, Pittsburg, Pa. In this roof the purlins were 10-in. I-beams and the jack rafters 4-in. I-beams, with 2-in. backing strips, 1-in. sheathing and tile roofing.

A simple case of the normal purlin problem involving but a part of the bevel angles is found in the skew portal. A clear idea of the similarity of the skew portal to the normal purlin will prove of value to the bridge draftsman in his first struggle with the normal purlin, if he has had experience with the skew portal. Using the following notation:

Let I = the inclination of end post to horizontal.

B = the angle between the center line of portal strut and the plane of the truss, measured in a horizontal plane.

All requisite bevel angles are functions of I and B and are as follows:

P = the amount the angle between (1) the center line of portal strut and (2) the line of intersection of the plane of the portal with the plane of the truss differs from 90°.

A = the angle between the plane of the portal and a horizontal plane.

G = the amount the angle between the plane of the portal and the plane of the truss differs from 90°.

M = the amount the angle between (1) the plane of the truss and (2) a plane perpendicular to the plane of portal and through the center line of portal differs from 90°.

X = the angle between (1) a vertical line in

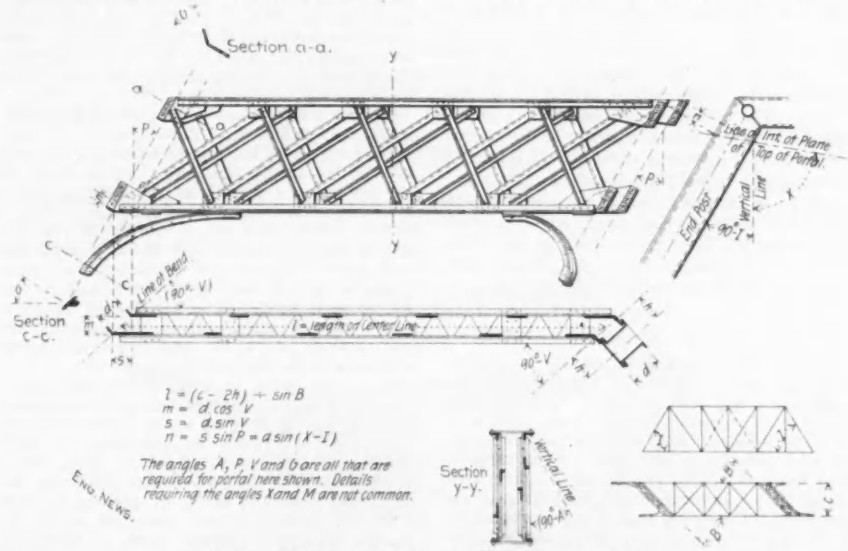
Section a-a.
Section c-c.
Section y-y.
Line of Bevel (90°-V)
l = length of Center Line
End Post
Vertical Line
Line of Intr. of Plane of Top of Portal
90°-I
l = (c - 2h) ÷ sin B
m = d cos V
s = d sin V
n = s sin P = d sin (X-I)
The angles A, P, V and G are all that are required for portal here shown. Details requiring the angles X and M are not common.
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FIG. 4. SKEW PORTAL ANGLE CONNECTIONS.

the plane of truss and (2) the line of intersection of the plane of the back of the portal with the plane of the truss.

V = the amount the angle differs from 90° between the center line of the portal strut and the line of intersection of the plane of truss with a plane perpendicular to the plane of the portal through the center line of the portal strut.

Then we have,

Tan A = tan I ÷ sin B, or cot A = cot I sin B (1)

Tan P = cot B cos A, or sin P = cos B cos I (2)

Tan G = sin I ÷ tan B, or tan G = sin I cot B (3)

Tan V = sin A ÷ tan B, or tan V = sin A cot B (4)

Tan X = tan A ÷ sin B, or cot X = cot A sin B (5)

Tan M = tan P cos V, or tan M = cot B cos X (6)

When the skew angle B = 45°, we have tan P = cos A; tan V = sin A; tan G = sin I and tan M = cos X. When the portal consists of a vertical top strut with brackets it is necessary to compute only the first three angles, A, P and G. It will be noticed that these equations are the same as those given for hip and valley roof angles. The similarity between the two problems is also shown by the skew portal drawings, Fig. 4. It will be observed that one end post takes the place of a hip rafter and the other of a valley rafter.

COST OF MACADAMIZING STREETS AT BURLINGTON, VT.

The city of Burlington, Vt., has a total extent of street of about 45 miles, of which about eight miles have been covered with macadam and about 12 miles have been graveled. Neither the macadam nor the graveled streets, however, have ever been satisfactory to the public. The gravel was too dirty and sandy to make a clean street, and it wore very rapidly. The macadam has been made from a sandstone rock, obtained inside the city limits, which, although very hard, was not a satisfactory road material, as it would not bind and was so brittle as to wear rapidly. Further, the making and laying of the macadam have been poorly done. The broken stone was not properly screened and raked of irregular slivers, and neither the foundation nor the macadam itself was properly compacted by rolling. The work of making and repairing has been done by local labor, employed directly by the city, and high wages have been paid to inefficient workmen, so that the cost of the road has not been light.

As a result of continued agitation, the city finally voted, at a special election last spring, to issue bonds for building improved roads to the amount of $20,000 per year for five years, the money to be expended under the direction of a commission, consisting of the Hon. Wm. J. Van Patten, Mayor of the city, Prof. V. G. Barbour, Professor of Civil Engineering at the University of Vermont; and Capt. Guy Howard, U. S. A., who is stationed at Fort Ethan Allen, near Burlington. The commission secured the services of Mr. W. S. Bacot, M. Am. Soc. C. E., to superintend the work of inaugurating a new system of road construction, and work has been in progress during the past summer. Mr. Bacot's report, which has just been presented, gives a most interesting account of the work thus far done, and we have compiled from it the following description. The first necessity was to find a suitable material for macadam. The local sandstone was discarded, and after some search a limestone from the quarries on Isle La Motte was selected for the body of the new roadways, with a wearing surface of trap rock, obtained on the New York shore of Lake Champlain. Both these materials were delivered in boat loads to the Burlington docks, which made the cost of transportation small.

The crushing plant includes a No. 4 Champion stone crusher from the American Road Machine Co., of Kennett Square, Pa., with screens and elevator, and an Ames engine and boiler. The storage bins are set 7 ft. above the ground, rising to a height of 20 ft. and containing four pockets of 30 cu. yds. capacity each. The pockets are elevated to permit loading directly into wagons. The total cost of this plant, stone crushing, including buildings, etc., was $2,345, and the plant was put in operation about the end of July, crushing limestone and trap rock. The efficiency of the plant was tested by Professor Ayer and Professor Votey, of the University of Vermont, the former making indicator tests to determine the horse power required to run the crusher, elevator and screens. The result of the observations indicated that the average power on the day of the test was 10.85 HP., the maximum effective power exerted being 25.7 HP. and the minimum 0.52 HP.

Mr. Bacot gives records of the crusher's work from July 23 to Sept. 8, or 42 working days. Limestone was crushed for 24 days and trap rock for 18 days and about 10 nights. The cost of running the plant during this period was as follows:

Labor	$836.33
Water for engine, etc.	4.96
Oil	46.88
Ice for men	2.13
Coal for engine	164.78
Insurance	15.00
Total	$1,070.08

These figures were derived from the records of the Street Department and, therefore, represent money actually paid out for the purposes mentioned.

In order to correctly ascertain the cost of crushing is was necessary to know the cost of labor, the cost loading boats; 2, breaking stone or preparing it for the crusher; 3, carting stone to crusher; 4, crushing the stone. The quantity of stone furnished by contractors was ascertained by measurement of boat loads, while the output was ascertained by measuring the team loads filled from the bins. This latter practice is not sufficiently accurate to be relied on, the most reliable method being to weigh the stone when loaded on the wagons. The amount of stone furnished by the contractor was 1,522½ cu. yds. of Isle La Motte limestone and 1,016 cu. yds. of trap rock from Trembleau Point, while the output, as deduced from the records of team loads hauled away from the bins, was 1,320 cu. yds. of limestone and 960 cu. yds. of trap rock. The discrepancy is probably due to a shrinkage of the volume after crushing and to errors in measuring the boat loads and wagon loads. The cost of unloading the limestone was 15.84 cts. per cu. yd., but the trap rock was delivered on the dock. The limestone cost 55 cts. per rubble cu. yd. delivered on the city dock. The record is as follows:

	Limestone. Cost per cu. yd. cts.	Trap Rock. Cost per cu. yd. cts.
Unloading	15.84	...
Breaking	5.90	7.21
Carting	8.85	5.84
Crushing (labor only)	13.56	13.36
Supplies for crusher, coal	6.41	8.34
Oil	1.81	2.38
Water	.25	.21
Miscell., Insur., etc.	.74	.77
Cost of stone at dock	63.44	116.25
Cost of crushed stone in bins	116.80	154.36

The paving of Pearl St. consists of a macadam roadbed 30 ft. wide and 8 ins. thick, the bottom course being of limestone and the surface course of trap rock, finished off with gravel as a binder. One block was made with limestone alone. The gravel affords the essential quality which the trap rock lacks, namely, the cohering or cementing quality which produces a smooth, tough and elastic road. The cost per sq. yd. of finished road was as follows:

Labor	21.77 cts.
Rolling	2.31 "
Sprinkling	.42 "
Gravel	1.04 "
Stone	44.20 "
Total	69.74 "

The average cost of the trap rock section was 75 cts. per sq. yd. and that of the limestone section 58 cts. per sq. yd. The cost of hauling the stone from the crusher to the street is included in that of labor. The teams were paid 35 cts. per load, which necessitated ten trips per day to make wages of $3.50 per day. The cost of hauling on this basis was 20 cts. per cu. yd., or 4.4 cts. per. sq. yd. of street.

The construction on St. Paul St. was of a different character, a 12-in. telford pavement, 18 ft. wide, being laid in the center of the roadway. The 8-in. bottom course is of limestone and the 4-in. surface course of trap rock, with gravel as a binder and top dressing. On North St. there is an 8-in. macadam limestone pavement, with sand for a binder and limestone screenings for finish.

In regard to the new system of street improve-

ments, Mr. Bacot points out that the undertaking of laying out such a system in any municipality involves the acquirement of a correct knowledge of conditions of grade, soil, and traffic, and certain local conditions of its main thoroughfares, business and residence streets. The topography of the city of Burlington is favorable to drainage, but not to traffic, and the steepness of the grades in the southern section tends to compel heavy teaming for points on the hill and northward from the docks and railways to concentrate on certain streets with the easiest grades, thus necessitating a more substantial treatment in these thoroughfares. The soil is mainly sand and clay. The question of volume of traffic in a city of this class does not figure prominently, for it may be safely concluded that in no single street does the traffic assume such proportions as to warrant the making of observations and compilation of records to determine its volume. The intensity of the traffic, or the weight of the loads per inch of width of wheel tire, is a matter of greater consequence, and of itself determines the requirements of the pavement. Thus it may be readily understood that the daily passage of 500 to 600 light teams over a gravel road would leave its foundations unimpaired and its wearing surface but little worn, while a daily traffic of a hundred teams bearing a burden of 6,000 lbs. would wreck the road in a few weeks. In the first place, even with still heavier traffic, the surface wear can be provided for by proper maintenance, but if the depth of roadbed is insufficient to bear the weights of loads imposed in all seasons, cross breaking and the ruin of the entire pavement are certain to follow. To place a weak road metal on a foundation of perfect stability is, if anything, worse than to coat an unsubstantial road bottom with durable material.

The possibility of cross-breaking of a road coating faithfully constructed and maintained on firm soils is remote, however heavy the traffic; and in such cases the engineer has to ascertain what minimum of thickness he can adopt with safety, rather than how good a road he can construct irrespective of cost. Working on these principles, Mr. Bacot recommends the following construction: 1, for principal thoroughfares, passing through areas of clay or doubtful soils, a 12-in. telford paving surfaced with trap; 2, for hillside roads in clay, 8-in. macadam with limestone surface; 3, main roads going east and west, 12-in. telford with limestone surface to reduce cost, all other telford roads having the trap rock surfacing; 4, for streets over sandy soil with heavy traffic, 8-in. macadam of limestone surfaced with trap or limestone, the latter being used where the traffic is moderate; 5, for streets with light traffic, 6-in. limestone macadam; 6, for streets in the northern section, where traffic is light and occasional, gravel roads will answer for many years to come. Gravel may also be advantageously used in maintaining certain streets as drives. The gravel should invariably be screened. Asphalt is recommended for certain business and shopping streets, but further experimenting with tar-concrete as a substitute for asphalt is not recommended, as its durability may be seriously questioned, owing to the tendency of the volatile components in the coal tar to oxidize and thus hasten the disintegration of the paving material. The recommended construction is 2 ins. of sheet asphalt laid on a 6-in. macadam base, covered with 1½ ins. of binding material, the total thickness being 9½ ins. Special attention is called to the fact that limestone is not a suitable or economical material for the wearing surface of streets having heavy traffic, and with limestone and trap costing respectively $1.16 and $1.54 in the storage bins, the net difference in cost for a 6-in. top course should not exceed 7½ cts. per sq. yd., or 25 cts. per lin. ft., on a street 30 ft. wide. Gutters 30 ins. wide are provided for in the engineer's complete estimate and schedule of street improvement, a summary of which schedule is given below, the general average of all classes of work being $9,500 per mile. The work will, of course, be spread over a number of years, but it is pointed out that the proposed limited appropriation of $20,000 per year is entirely too small for satisfactory results, providing for only about two miles of street per year.

Concerning the present streets, Mr. Bacot states that the city presents to the eye a system of roadways tilted in cross section, needlessly so in many cases, and on established thoroughfares it is too late to change, but such a system should not be perpetuated in new work. For the gutters he recommends a pitch of 3 ins. per. ft. as sufficient in most cases. In forming the surface of streets the crown

Estimate for Proposed Street Improvements at Burlington, Vt.

	Length, Miles.	Area, Sq. yds. pav't.	Cost of pav't.	Gutters, Ft.	C't of gut'rs.	Total cost.
Asphalt	1.105	23,906	$52,834	....	....	$52,834
Telford, 12-in.	6.057	62,566	59,697	16,269	$1,899	61,596
Macadam, 8-in. trap	8.043	145,274	97,957	29,234	3,030	100.987
Macadam, 8-in. limestone.	8.653	113,666	76,635	36,789	4,253	80,908
Macadam, 6-in. limestone .	6.320	83,518	43,365	50,068	5,733	49,099
Gravel, 6-in..	11.080	134,247	48,865	63,572	8,530	57,395
Total	38.258	563,177	379,373	195,932	23,445	402,818

should vary with both the width and the grade, varying from 1-30 to 1-40 of the width for grades under ½% and over 5%, and from 1-40 to 1-50 for grades from ½% to 5%. On well-drained soils the crowns can be flattened if desired, but not on wet soils. For maintenance he recommends a limited "block" system, the blockmen only attending to slight repairs, and the bulk of the repairs being done by the general corps. In the business part of the city each maintenance district would be from ½ to ¾ of a mile in length, with one blockman to each district. The asphalt sections would require men stationed at intervals of ¼ mile to keep the street clean. Outside of the central section the extent of the districts will depend upon the traffic, but should never exceed one mile of street. Each blockman would be equipped with a square shovel, broad, heavy rake, pickaxe, reed street broom, wheelbarrow, iron tamper with broad base and a sprinkling can. These men would make immediate repairs to the street, first picking or "stocking" the surface, applying road material and tamping it down, and then finishing with a little binding material, leaving the patch slightly higher than the road surface.

The system of organization for the street department which Mr. Bacot recommends we have given in a separate article (Eng. News, Dec. 6), as it is of special interest in connection with the general question of the control of municipal public works.

WIND BRACING IN HIGH BUILDINGS.*

On the question of safe construction for positive dead loading there is substantially no disagreement among engineers, and the proper allowances for loading floors are also generally agreed upon. The question naturally presents itself, however, whether modern buildings are being constructed with sufficient regard to the various live forces acting either vertically, horizontally or otherwise. Most designers of high buildings are satisfied that their structures are safe, but such convictions are not always based upon scientific reasoning. All engineering designs for high structures, such as towers and chimneys, are built to resist wind pressures of from 25 to 50 lbs. per sq. ft. of exposed surface. The sizes of building lots in large cities remain unchanged, but the heights of buildings have increased so that many now extend 250 ft. above the curb level, and there are instances of buildings varying from 23 to 25 ft. in width, which are from 120 to 125 ft. in height, with 100 ft. of this height exposed to the wind. In such cases, if there is any question as to their power to resist destructive forces, the doubt should always be on the side of safety. Instances may be seen in structures with the dimensions just given, and from 80 to 100 ft. deep, which are almost identical in general character and plan, where in one case dependence is placed upon the cross-partitions, the end walls with ordinary girder connections and the columns for transferring the horizontal forces to the ground, while in others careful bracing has been introduced. It must be, therefore, that in the latter case there has been an excess of expense, or in the former there is not sufficient strength. It may be said that partitions as ordinarily constructed cannot be depended upon to act in conjunction with the steel structural work in resisting lateral forces, and there will be a limit beyond which partitions will not take up these forces, and the steel frame must resist them.

Dr. Draper has given wind pressures, registered at Central Park, New York, in different storms, of 49¼, 36¼, 44 and 21¾ lbs. per sq. ft. At about the time of the latter a building under construction at 74 Monroe St. collapsed. Dr. Draper's pressure gages were but 53 ft. above the ground, and the protection from surrounding objects prevented the pressure from being as high as it would have been at greater altitudes. The velocity gages on the Equitable Building give much greater averages than those of Dr. Draper; thus, in one case, while the first gave 48 miles per hour, the second gave only 24 miles. Maximum pressures are of short duration, but sometimes repeat themselves at intervals, and thereby tend to set up an oscillation in structures upon which they act.

The writer is unable to find any engineer willing to assume the responsibility of using a horizontal pressure less than 30 lbs. per sq. ft. on the exposed part of high buildings. An argument often presented is that the maximum pressures exerted on buildings are simply from local gusts of short duration, and that their impulses are absorbed in overcoming the inertia of the mass. If this be true in high buildings, the structure must act as an elastic body, and the wind impulses must be of so short duration that before the reaction of the elastic mass has taken place the force of the wind has subsided and the impulse has been exhausted in internal work. Should there be a succession of such impulses, and one come not in harmony with the vibration created in the material, the heavier the mass, the more detrimental would its weight become when the oscillation and the impulse act together. No horizontal force on one side of a structure can cause a vertical reaction on the opposite side without being transferred through the intervening construction.

The data required for consideration in any case seem to be as follows: 1, the maximum amount of wind-pressure on good-sized areas at various altitudes, and under all ordinary circumstances in the especial locality, together with the length of time during which such pressures act; 2, experience on the strength of partitions, walls, etc., to resist vibrations and thrusts under conditions similar to those existing in buildings; 3, experience to determine to what extent the mass of the structure directly absorbs the impulses of wind pressures.

Suppose a warehouse building 23 ft. front and rear, 93 ft. deep and 85 ft. high, situated on an alley-way on one side, with a three-story building on the other, and let us discuss the effect which wind blowing on the exposed portion of the building will have, assuming the walls are of brick, 28 ins. thick in cellar, 24 ins. in first and second stories, 20 ins. in third, fourth and fifth stories, and 16 ins. in sixth and seventh stories. Under such conditions the writer computes the limit of the wind pressure that can be cared for by dead weight to be 6½ lbs. per sq. ft. on the entire exposed surface above the adjacent building, and anything above this must be carried through the structure to the foundation.

A wooden beam, with chamfered ends, as usually laid in a wall, not anchored, can exert no resisting moment, but when built up solidly against the wall and well anchored it can resist something. If the beams are 3 × 12 ins., spaced 12 ins. c. to c., with every sixth beam anchored, the writer estimates that an additional resistance of ¾ lb. per sq. ft. would be available, making a total resistance of 7¼ lbs. per sq. ft. of exposed surface, which is equivalent to a wind velocity of 42½ miles per hour. In the city of New York, however, this velocity will in violent storms reach 70 miles per hour on a building of this height, giving a total wind pressure of 20 lbs. per sq. ft., and leaving 12¾ lbs. to be provided for by some part of the structure not yet considered. This pressure has to be carried down through the floors, which, if well constructed, will form trusses sufficient to transmit it to the ends of the building. If provision has been made in the front, it can be safely carried through the front to the ground.

The writer then mentions a number of buildings, in some of which evidence of yielding has been seen. The collapse of the building No. 74 Madison St., which was 20 ft. front, 92 ft. deep and 75 ft. high above curb level, is mentioned. The storm which wrecked it gave an average velocity, according to the U. S. Weather Bureau on the Equitable Building, of 10 lbs. per sq. ft. At the Central Park Observatory the maximum impulses (which lasted one second) gave 21¾ lbs. The wind evidently caught the unfinished building nearly broadside, or at a sufficient angle to throw a considerable pressure against the leeward wall through the unfinished open front. The front portion was thrown completely down, while the rear portion remained intact.

The writer next considers the case of a 17-story skeleton structure, a fireproof office building on the corner of two streets, 32 ft. front, 100 ft. deep and 194 ft. high above curb level. The long side not facing the street was protected by an adjacent building for 50 ft. of its height, which was sufficiently strong to resist wind-pressure coming to it from the building. The writer assumes that knee-bracing is used at the junction of the floor system with the columns, in which case the amount of wind pressure which may be safely resisted would depend largely upon the kind

* Abstract of a paper by Guy B. Waite, presented at the meeting of the American Society of Civil Engineers, Dec. 19.

of column connection. He assumes that the partitions and cross walls have been separately built, with a view of resisting horizontal forces. The partitions to be of 4-in. terra-cotta blocks, laid in Portland cement, and the floor beams able to withstand the strain from the partitions when acting as braces; then we will have in principle a system of trusses, with partitions acting as struts. He figures out that the total resistance from the columns and the walls which can be relied upon will amount to 6 lbs. per sq. ft., equivalent to a velocity of 38½ miles per hour; and that to provide for 87 miles per hour, or about 30 lbs. per sq. ft., the bracing must be capable of taking 24 lbs. horizontal pressure.

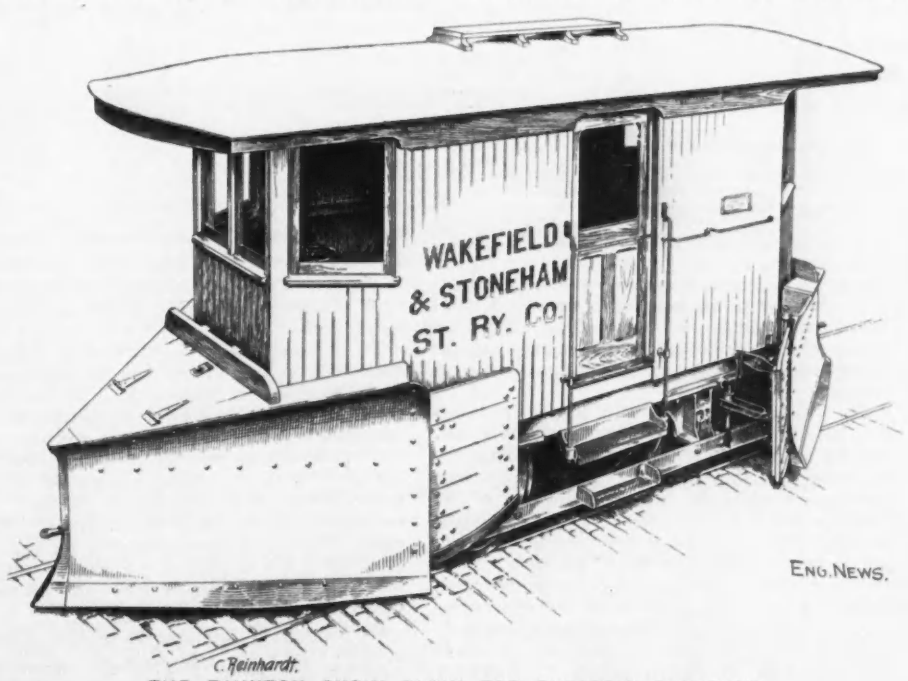
He shows that the resulting stress, when carried down through the columns, will amount to a sum too great to be safely resisted by cast iron. Buildings of this description should therefore be provided with steel columns, and it is generally found economical to increase the section where maximum bending occurs in taking up transverse loading.

Attention is then called to a skeleton-constructed building 23 ft. front, 85 ft. deep, and 125 ft. high above curb, which was protected from wind by buildings 60 ft. high on either side. Wind pressure was provided for by means of the front and rear walls, and the special connections of the cross-girders with the columns. The constructor was careless in regard to the details, and instead of utilizing the entire depth of the girder, he gouged holes for fastening it to the columns in the middle part of the girder webs. When completed, except the top story and the floor arches, yet to be put in the three upper floors, during a storm, the building moved 8 to 10 ins., beginning at the roof of the adjoining westerly building and increasing to the top. The reason was that under the force of the wind the building had to move until the joints came to a firm bearing. It was righted and made secure by knee-bracing. Attention is called to the necessity of carefully executing the details of structures of this character, as otherwise elements of great danger may be introduced.

A NEW SNOW PLOW FOR ELECTRIC RAILWAYS.

We illustrate herewith a new snow plow for electric railway service, which is quite a departure from old ideas in this field. Thus far electric railways have generally imitated their predecessors, the horse railways, by using large sweepers with revolving brushes to clear their tracks. While this is undoubtedly the best practice in city streets where the track must be kept cleaner than can be done by any plow or scraper, there is now a large mileage of electric railways in suburban and county districts operated under conditions approximating more nearly to those of steam railway practice, and for these the plow illustrated is especially adapted. It consists essentially of a four-wheel car with a nose plow and adjustable wings at each end, so that it can be run equally well in either direction. The operating levers are within the car, leaving a clear floor space of 6 × 17 ft. The weight of one plow is balanced by that of the other, so that not only is the load on the wheels evenly distributed, but the operator in lifting the plow has only to overcome the friction of the mechanism. The plows are raised by a parallel motion and so rise squarely from the track, the rear plow having a clearance of 8½ ins. above the rail. There is ample room for the electric motors, the lifting apparatus being only at the ends. Each side wing is operated by an independent lever. The digger mechanism is thrown down by a kick of the foot, and may be raised instantly by one hand by throwing the lever a short distance. The digger iron is held to its work by a flat spring, which is strong enough to cut away ice and snow, but will yield enough to give way if the digger strikes the end of the rail, a switch or a frog. A sand or salt spout is provided for each wheel. The leverage of the brakes is such that 25 lbs. on the brake handle applies a pressure of 1,000 lbs. on each brake shoe. The working mechanism of all parts is located at each end of the car and the body of the car left free for salt, sand and men. The beveled shape of the ends, with the sliding windows, gives an opportunity for looking forward or back and there is no necessity for going outside of the house to do or to see anything. Any size of wheel can be used, but the preferable size is 33 ins., with ⅞-in. flange. The wheel base is 6 ft. 6 ins. The plow weighs, when ready for the motors, seven tons. It is strongly built, as may be seen by the statement that it carries over three tons of castings and a ton of forgings. The design for this plow was prepared in the office of Dean & Main, Boston, Mass., under the direction of Mr. F. W. Dean, M. Am. Soc. M. E.

These plows are especially adapted for heavy cross-country or suburban single-track work, and about twelve have already been sold. A plow of a somewhat lighter design for use in and about city streets is being built for use at Fall River, Mass. The plows are built by the Taunton Locomotive Mfg. Co., of Taunton, Mass., to which we are indebted for the photograph from which our illustration is reproduced.



THE TAUNTON SNOW PLOW FOR ELECTRIC RAILWAYS.

STREET CLEANING IN SAN FRANCISCO.

Street cleaning in San Francisco is done by the Merchants' Association, represented by Mr. F. W. Dohrmann. This association was organized to effect reforms in public matters, and has contracted to clean the streets from Nov. 1, 1894, to June 30, 1895, under quite rigid specifications. Only $80,000 was available for street cleaning for the fiscal year ending June 30, 1895. This sum, it is said, is insufficient, so the association has taken the contract for less than cost, expecting to make up the deficiency by subscriptions.

The specifications provide that all paved public streets and alleys must be swept and cleaned with effective approved machines, or by hand, or both, under the direction and to the satisfaction of the street superintendent and street committee of the board of supervisors. Streets must be sprinkled by a watering cart before sweeping when and where necessary, and hand labor must be used to supplement, or in place of the machines where necessary.

All day sweeping must be done between 6 a. m. and 5 p. m. and the streets designated to be swept by machines must be cleaned between 6 p. m. and 6 a. m. Where a street is swept only once in 24 hours it may be done by hand or machine, at the option of the contractor and with the approval of the street superintendent. Streets cleaned a second time, or oftener, in 24 hours must be swept in the daytime, by hand labor. The contractor may be ordered to keep certain streets clean from 6 a. m. to 5 p. m., which, of course, means practically the block system of hand labor. All sweepings must be promptly removed to specified dumps and a penalty of $2 is provided for each load of sweepings not deposited in its proper place.

The contractor is required to report by 12 o'clock daily in writing to the street superintendent what streets have been cleaned during the previous 24 hours. The superintendent must examine these streets, and if satisfied with the work must enter in a book the names of the streets and the number of square yards cleaned. If not satisfied no payment is allowed.

The contract was awarded to the association on the following basis: For each sweeping done not oftener than once in 24 hours 30 cts. per 1,000 sq. yds.; for sweeping a second time within 24 hours, 15 cts. per 1,000 sq. yds., it being required that this work shall be done by hand labor; for keeping a street clean all day (hand labor), that is, from 6 a. m. to 5 p. m., 60 cts. per 1,000 sq. yds., except that for Market St. 90 cts. is paid. Whenever in the judgment of the street superintendent and street committee of the board of supervisors bad weather renders cleaning inexpedient, work may be suspended by the contractor, provided that the crosswalks on Market, Kearney and other streets designated by the superintendent shall be kept clean during the daytime. For keeping clean "each set of cross-walks across a street or street crossing" when the regular street sweeping is suspended, the city pays 10 cts. a day.

THE LOBNITZ ROCK-CUTTERS ON THE DANUBE.

A short paper on "The Removal of the Iron Gates of the River Danube" was lately presented to the Institution of Civil Engineers by Mr. Oscar Guttmann, Assoc. M. Inst. C. E. The paper gave a general description of the work to be done, but the most interesting part related to the actual performance of the rock-cutting system of Mr. Fred. Lobnitz, described and illustrated in our issue of Jan. 26, 1889.

As now used on the Danube, this machine has one, instead of ten, cutting bars, as the rapid current and local conditions make one cutter of great weight more efficient than a battery of cutters of various weights. The barge now in use is 100 ft. long, 25 ft. wide and 7 ft. deep, with a draft of 3 ft. The boiler is placed near the stern and near it are the manoeuvring winches for moving the boat. Near the center is a tripod for handling the cutter. This latter may be worked through a square well, forward of the center of the boat, or may be swung over the bow of the boat by tilting the tripod forward.

The action of the cutter is that of a pile driver, the cutter replacing the falling "monkey." The cutter is made of wrought iron or mild steel. It is 30 ft. long and is square in section, the dimensions being 7 ins. square at the top, increasing to 13 ins. square 10 ft. from the point, and diminishing again to 11 ins. square at the lower end. For a length of 4 ft. from the bottom a hard steel core, 11 ins. by 4 ins., is welded in along the center line of the bar, with the point chisel-shaped, and the sides are rounded off to 9 ins. radius. The cutter point is hardened by heating to a cherry red and plunging

it into water. This steel blade, being protected on two sides by wrought iron, can be used up to the last few inches without breaking and always keeps sharp. It weighs 8½ tons.

The boat is advanced after 20 ins. in width of the rock has been broken away by the falling chisel, but the varying hardness of the rock prevents any accurate statement of work accomplished. The cutter is dropped about 16½ ft. at a rate varying from 50 to 100 blows per hour, the speed depending upon the amount of shifting of the boat necessary. The average amount of rock removed per blow is 2 cu. ft. It should be said that the rock is very hard. One great advantage of the system is that the rock is always small enough to be removed by dredging. Up to Aug. 15, 1893, 22,315 cu. m. of rock had been broken down by the Lobnitz cutters, the largest part being done in 1892. There are two machines of the kind above described now at work, and a third one carries the cutter machinery on a platform between two boats. They are described as working satisfactorily and giving good results.

The drilling of bore-holes for blasting operations is carried out on two plans—the Ingersoll-Sergeant and the Fontane systems. The first is a scow which can be lifted from the water by four legs resting on the bottom and connected with hydraulic jacks fed by a Worthington pump. Along the side of this scow are ranged four Ingersoll steam drills, supplied by a boiler on the scow. In the Fontane system the drills are mounted on a platform resting upon two barges. The author says that while there has been trouble with the Ingersoll-Sergeant system, it has, on the whole, given satisfaction; the Fontane barges are too light for the work to be done and the system is not yet looked upon with satisfaction.

According to official returns, up to the end of 1893, the quantity of work then executed was as follows:

Class of work.	Cu. meters.	P. c. of estimated total.
Blasting under water (with 67,536 cu. m. removed)	122,758	77.77
Blasting at the Iron Gate	307,223	90.60
Stone deposited	345,978	68.93
Various stone depositing	133,065	20.05
Stone revetment	9,150 sq. m.	.....
Facing-up dams	56,340 "	.....

THE FORESTS OF THE UNITED STATES.

The last annual report of Mr. B. E. Fernow, Chief of the Division of Forestry of the U. S. Department of Agriculture, contains much information for those interested in the preservation, maintenance and products of American forests.

The extent of forest lands in the United States is shown by a map with the several states tinted to show the relative percentage of timber land contained in them as compared with total area. The maximum percentage of forest-covered lands, over 60%, prevails only in Maine and Arkansas. A second map shows the conditions prevailing in the country west of the 97° of longitude, covering the "dry region" of the United States, and, therefore, requiring close attention for the conservation of water supply. This map also shows the forest reservations.

Taking the whole United States by groups, the following table shows the approximate extent of improved and forest lands:

Groups.	Area, acres. Land surface.	Per cent. Improved farms.	Improved land.	Brush and waste.	Probably forest.	Brush land.	Open country.
New England	39,710,000	10,736,000	27	73	52	..	..
Middle Atlantic	71,401,000	35,772,000	50	50	28	..	..
South Atlantic	114,724,000	31,790,000	27	73	49	..	..
Gulf States	126,426,000	19,467,000	16	84	50	..	..
Northern lumbering	122,294,000	30,786,000	25	75	42	..	..
Northern agricultural	84,908,800	59,114,000	69	31	13	..	..
Prairie States	250,754,000	75,769,000	30	70	4	..	..
Eastern Rocky Mt.	300,154,000	3,447,000	1	99	13	21	66
Western Rocky M.	249,047,000	1,981,000	0.7	99.3	8	23	69
Pacific Coast	203,048,000	17,558,000	8	92	30	27	35
Rocky Mt. region	549,201,000	5,458,000	1	99	10	21	68
Atlantic Coast	225,835,000	78,298,000	35	65	43	..	..
Central States	146,031,000	51,002,000	35	65	48	..	..
Interior States	396,785,000	126,162,000	32	68	20	..	..
Lake States	207,202,000	89,900,000	43	57	31	..	..
United States	1,900,800,000	357,616,000	18	82	26	..	..

The above table is founded on the returns of the census of 1890, for the area of improved farm land; the area of forest, brush and waste land was obtained by deducting the total of improved land from the total land area of the several states; the part supposed to be forest, in the percentage column, is estimated upon information obtained by various agencies.

As regards the consumption of forest supplies, no full statistics are available, yet we have now a better basis for estimates than ever before. In the report for 1892 it was stated that the total annual consumption was about 22,000,000,000 cu. ft., or 350 cu. ft. per capita, of all kinds of wood. With additional information furnished by the late census this figure can readily be increased to 24,000,000,000 cu. ft. The consumption of mill timber,of sizable logs, was given as about 4,000,000,000 cu. ft.; this is now found to be an under-estimate by 15%. If the annual growth of timber is assumed at 10 cu. ft. per acre, it would require at least 400,000,000 acres of well stocked forest land to supply this part of our consumption alone. If we add the consumption of firewood, largely made up of sizable timber, it is safe to say that three times the above area would be required to meet this consumption by its annual growth. This statement is alone sufficient to refute the claims of those who say there is sufficient and "inexhaustible" supplies in our forests, for it is based upon data highly favorable to their side of the question.

It is shown that in Wisconsin the average log has dwindled down from 18 ins. diameter (say, 200 ft. per log) in 1880 to 13 ins. (or 84 ft. per log) in 1893, and while in the former period the census statistics were based upon the practice of taking nothing less than 10 ins. diameter, the lumbering is now extended to logs as small as 5 to 6 ins. diameter. Reference is made to the inaccurate assertions as to the forest growth and timber consumption, which were discussed in our issues of March 23, May 11 and June 8, 1893, and more recent information shows still more strongly the inadequacy of the forest area to meet the growing demands upon the supply.

The Eleventh Census statistics of lumber production have been gathered by Mr. George A. Priest, but are not yet published in the Census Bulletins. A summary of these returns is given by Mr. Fernow, supplemented by data and estimates of the Forestry Division. An abstract of this summary of the amount and value of forest products in 1890 would appear as shown in the second table.

Class.	Quantity.	Estimated cubic contents of forest grown material, cu. ft.	Value.
Mill products:			
Agricultural implements, ft. B. M.	30,000,000	.....	$582,000
Bobbin and spools, ft. B. M.	49,000,000	.....	688,000
Carriage and wagons, ft. B. M.	66,000,000	.....	1,306,000
Furniture stock, ft. B. M.	94,000,000	.....	1,435,000
All other sawed lumber, ft. B. M.	27,630,000,000	.....	310,818,000
Total sawed lumber, ft. B. M.	27,869,000,000	4,000,000,000	314,829,000
Lath, pieces	2,365,000,000	200,000,000	3,709,924
Pickets and paling, pieces	110,000,000		750,000
Shingles, pieces	9,276,000,000		17,000,000
Staves, "	1,178,000,000	300,000,000	7,762,000
Headings, sets	183,000,000	175,000,000	4,934,000
Total products directly from logs	.....	4,675,000,000	$348,984,924
Railway construction:			
Ties, pieces	80,000,000	400,000,000	.....
Round and hewn timber in bridges and trestles	.....	80,000,000	.....
Telegraph poles	.....	5,000,000	.....
Totals	.....	485,000,000	$40,000,000
Exported timber	.....	12,000,000	4,730,000
Wood pulp	.....	75,000,000	3,550,000
Miscellaneous mill products other than lumber from logs	.....	80,000,000	20,765,000
Total of sizable timber*	.....	5,500,000,000	450,000,000
Fuel, as wood	.....	18,000,000,000	450,000,000
" as charcoal	.....	250,000,000	7,000,000
Wood for dyeing and charcoal for gunpowder	.....	16,200,000	437,000
Total amount	.....	23,766,000,000	$907,437,000

* Mr. Fernow says the total miscellaneous mill products is a considerable under-estimate, as given by Mr. Priest, and he raises it to the total given above.

In addition to the above timber products, there were used during the census year of 1890 other forest products, to the value of $25,882,872. These include turpentine and rosin, wood alcohol, tanning materials ($10,400,000), and maple sugar and syrup ($5,500,000). Adding the value of these by-products we have, with 10% added for omissions and under estimates, a total value of$1,026,650,859, for all the wood and forest products used in 1890.

Mr. Priest estimates the different kinds of timber sawed during 1890 as follows:

	Ft. B. M.
White pine	11,300,000,000
Spruce and fir	4,483,000,000
Hemlock	3,390,000,000
Hard pine, cypress, etc.	5,516,000,000
Redwood	317,000,000
Hardwood and all others	5,517,000,000
Total	30,593,000,000

The total imports of wood and wood products for the years ending June 30, 1892 and 1893, were valued at $21,806,740 and $26,028,997 respectively. These products included cabinet woods, cork, bamboos, rattans and canes, etc. The exports of wood and wood products in the same years amounted to $42,729,407 and $43,097,786. These exports included agricultural implements, carriages and horse-cars, cars for railways ($1,320,265), rosin, turpentine, boards, staves etc.

There is an interesting statement of the progress of the timber investigations undertaken by the government, and in regard to the test work it is pointed out that this will have to be divided into wholesale or commercial testing and testing for finer correlations, especially between structure and qualities. In the chemical analyses of woods, the work on tannin has had further attention, and about 1,000 analyses of bled and unbled timber confirm the correctness of the former statements, that the "bleeding" of timber for turpentine has no effect upon its strength.

The national forest reservations in the United States now number 17 and cover an aggregate area of 17,564,800 acres, with the area of the Afognak forest of Alaska unknown.. The largest forest reservations are the Sierra Nevada, 4,096,000 acres; the Cascade Range reservation, of 4,492,800 acres; the Yellowstone timberland reservation, 1,239,000 acres; White River reservation, 1,198,080 acres, and the Grand Canyon forest reserve, of 1,851,520 acres. The Yellowstone National Park contains 2,142,720 acres; the Yosemite Park, 967,680 acres; the Sequoia Park, 161,280 acres, and the General Grant National Park, 2,500 acres.

Mr. Fernow, in discussing the advance of forestry interests during the year, says that the states of New Hampshire, New York, Pennsylvania and New Jersey are becoming more active in regard to their interests and are enacting laws, of more or less efficiency, looking toward forest preservation. In the West there is rather a retrograde movement. For political reasons California has abolished its Forestry Commission, organized eight years ago. Colorado has practically abandoned its first attempt at a forest policy by leaving its commissioners without salary or means to proceed. Wisconsin, however has started a forestry commission on a practical basis, co-operating with the lumbermen.

The report then gives in very considerable detail the methods of German forest management. This includes its history from the time of Frederick the

Great, forest regulations, mapping, valuation work, arrangement of age classes, yield calculations, felling, harvesting and transportation. The prices of wood products abroad and the degree to which these values are affected by improved roads are also commented upon. Under the latter head it is shown that the increase in profit on timber equalled 33% on the investment in improved roads. While the United States is not yet educated up to the point of adopting all the refinements of forest culture enforced upon European states, a study of the methods there prevailing and an adoption in part at least of these methods would be even more profitable here. According to Mr. Fernow's statistics, the time is rapidly approaching when our states will be compelled to adopt some measures for the prevention of waste and for the maintenance of our timber supply.

HINGED CONCRETE ARCH BRIDGE OVER THE DANUBE AT MUNDERKINGEN.*

The bold design and unusual construction of this bridge, which was built in 1893, at the city of Munderkingen, in Wurtemberg, have attracted general attention and especial interest among engineers. The arch has a clear span of 50 m. (164 ft.) and a rise of 5 m. (16 ft. 4⅞ ins.). It would have been costly to build a pier in the river at this place, and this, as well as a consideration of the fact that several long-span stone bridges had recently been successfully built in the Schwarzwald of Wurtemberg, led to the adoption of a single span. Furthermore, excellent sand and gravel were to be found at the site, and several cement works furnishing a superior article being located near by made it natural to adopt concrete as the principal building material.

The foundation on the right side, or city side, is on natural rock, which, at this place, crops out at the surface; on the left side, however, the rock lies deeper, and here piles were used, driven at an angle of 15°. Experiments made at the technical high school at Munich upon the strength and compressibility of concrete blocks of various compositions had shown that, other things being equal, concrete made of broken stone was decidedly superior to that made of gravel. Furthermore, tests made in 1890 at Bauschinger's laboratory indicated that arches made of concrete offered greater resistance to compression than did red sandstone arches, and hence would not deflect as much at the crown.

The concrete used was composed of clean limestone and gravel about 1½ ins. in diameter, which were ground to a smaller size in the concrete mixer, shown in Fig. 2.

This concrete mixer consists of an iron cylinder 1.5 m. (4 ft. 11 1-16 ins.) in diameter and 1 m. (3 ft. 3⅜ ins.) long, revolving on a horizontal axis. Inside the cylinder are 40 steel balls, each 12 cm. (4¾ ins.) in diameter and weighing about 300 kg. (660 lbs.). In the circumference of the cylinder is a door, through which the stone, cement and sand are put in and the mixed concrete taken out; a grating, with bars 11 cm. (3⅜ ins.) apart prevents the balls from falling out. The drum is rotated by a 6 HP. portable engine. The materials are first mixed in a dry state for two minutes and then water from a reservoir at one end of the mixer is sprinkled through the hollow axis and the mixing is continued for three minutes longer. The capacity of the drum is 0.6 cu. m. of concrete (21.2 cu. ft.); or 36 cu. m. (1,271 cu. ft.) in 10 working hours. The effect of mixing the concrete in this manner is not merely to reduce the sizes of the stone and gravel by grinding, but principally to cause the cement to firmly adhere to the surfaces of the other materials. The strength developed by the concrete thus mixed was uncommonly high.

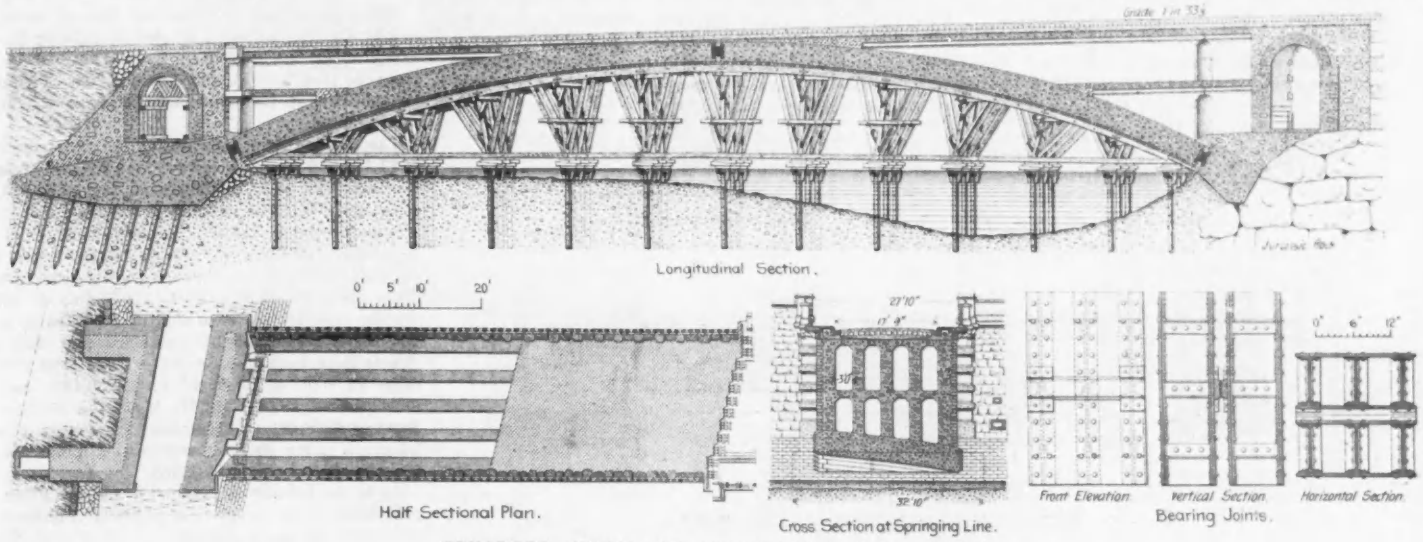
For the purpose of statically sustaining the arch, and also to compensate for any settlement of the foundations or deflections of the arch, it is hinged at the center and at the abutments. There are 12 such hinges at the crown, and twelve at each abutment, and each hinge is made of two steel boxes, built of I-beams and plates 50 mm. (2 ins.) wide, 23 mm. (⅞ in.) deep and 80 mm. (3⅛ ins.) high; the boxes are free to turn one on the other, through a ball joint placed between the boxes at the center.

The arch is 7.5 m. (24 ft. 7¼ ins.) wide. It is calculated for a live load of 400 kg. per sq. m. (80 lbs. per sq. ft.); the specific gravity of concrete is taken at 2.3. The thickness at the crown is 1 m. (3 ft. 3⅜ ins.) and at the abutments 1.1 m. (3 ft. 7 5-16 ins.). At other points the thickness is such as to keep the line of resistance within proper limits and preserve a uniform unit strain throughout the arch. The backing is formed of hollow arches above the haunches and the spandrel is faced with concrete; the arch ring is faced with limestone projecting about 8 cm. (3⅛ ins.). The roadway which crosses the bridge is macadamized; the sidewalks on each side of the roadway shown in the cross-section are paved with concrete blocks and have an iron railing at the edge.

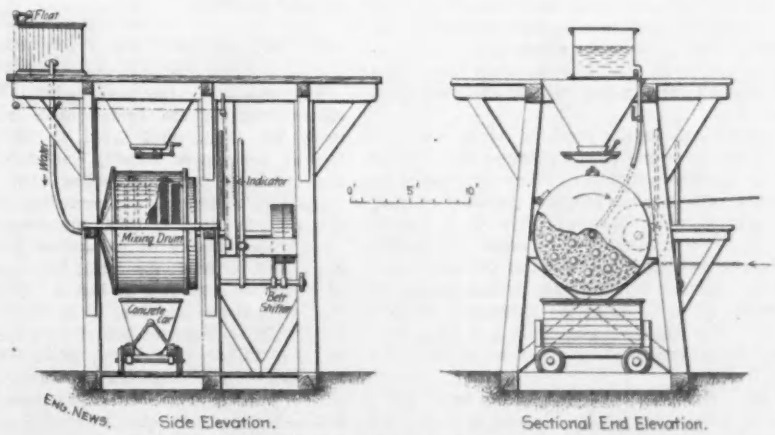
The falsework was erected on piles and consisted of twelve bents supporting the arched longitudinal stringers on double wedges. The flooring, resting on these stringers, was made of 4 × 4-in. planks laid close together, but not nailed. The faces of the arch were covered with boards. The concreting was done in layers 30 cm. (11¾ ins.) thick, these commencing at the abutments, where the metal hinges were first put in place, and working alternately from either end towards the center for a distance of 8 m. (26 ft. 3 ins.); the work then proceeded from the neighborhood of the crown, and finally the remaining openings were filled in. The hinges at the crown were adjusted and concreted 19 days after commencing work; 28 days after closing the arch the planking was removed. The deflection was then observed for a long period of time and amounted to 116 mm. (4 9-16 ins.). This deflection, as well as the settlement and compression at the left abutments, had all been provided for by raising the falsework a sufficient amount. The construction lasted in all seven months, after which the bridge was opened to traffic. It has not so far shown any defects.

The cost was as follows (1 mark = 23.8 cts.):

Foundations	$3,332
Falsework	1,630
Superstructure	9,615
Superintendence, etc	2,261
Total	$16,808



CONCRETE BRIDGE AT MUNDERKINGEN, GERMANY.



CONCRETE MIXER USED AT MUNDERKINGEN BRIDGE.

*Abstracted from the Journal of the Austrian Institute of Engineers and Architects, by O. J. Marstrand, M. Am. Soc. C. E.

Or, for a clear span of 50 m. (164 ft.) and a width between railings of 8 m. (26 ft. 3 ins.) the price is about $3.90 per sq. ft. of traffic surface. The total expenditure, including roadway paving and railing, amounted to $21,429.

THE McKAY GARBAGE CREMATORY, AT YONKERS, N. Y.

((With inset.)

The city of Yonkers, N. Y., began to burn its garbage in November, 1893, making use of a crematory designed and built by Mr. John E. McKay, M. Am. Soc. C. E., First Assistant Engineer, Croton Aqueduct. Mr. McKay contracted to build a furnace capable of burning all the garbage of the city, the population of which, in 1890, was 32,033. The character of the population is largely residential, but a considerable amount of manufacturing is carried on. The furnace is designed to burn 80 to 90 cu. yds. of garbage per day, operating continuously during the whole 24 hours.

In connection with the contract requirement specifying that the furnace shall burn all the garbage of the city, there is nothing to the effect that ashes and other foreign matter must be excluded from the garbage, but, undoubtedly, this is the meaning of the contract.

The contract price for the furnace, without the building which covers it, was $5,000, including all repairs for the first six months. Mr. McKay says that the furnace cost him more than this, but he did the work at a low price, in order to get a furnace into practical operation. The building, Fig. 1, on the inset, was erected by the city at a cost of $3,750. It is 33½ × 52 ft., with a lower story of brick and an upper story of frame construction. The upper story is covered with corrugated iron and the roof is of tin.

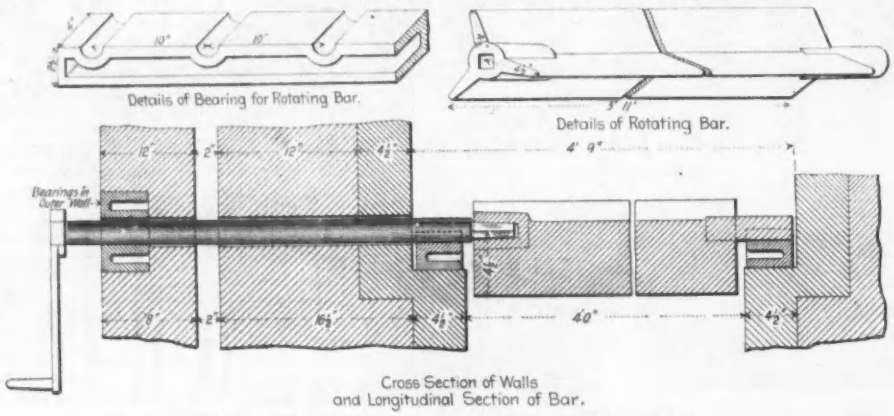


FIG. 7. DETAILS OF ROTATING GRATE BARS.

The character of the furnace is shown by the accompanying illustrations on the inset, and in the text, Fig. 2 being a longitudinal section, Figs. 3 and 4 sectional plans, and Figs. 5 and 6 cross-sections of the furnace, while Fig. 7, in the text, shows the details of the rotating grate bars. It will be noticed that there is a fuel grate at each end of the furnace, the rear one being at a higher level than the other; also that there are two garbage grates, the upper with rotating and the lower with fixed bars. The garbage carts pass up the gangway shown in the view, Fig. 1, and dump their loads directly into the drying and burning chamber, Figs. 2, 3 and 6.

The fire on the upper grate, aided by the heat from below, dries and partially burns the garbage while in the upper chamber. The rotating grate bars are brought into use to dump the dried garbage into the incinerating chamber, Figs. 2, 4 and 6, where the lower fire burns it to ashes. The ashes are removed through doors below, at the rear, these doors also serving to admit air, which passes up through the ashpits. After the garbage is dumped from the upper chamber, and while it is being consumed below, another charge may be admitted as before.

The ducts from the air spaces in the outer walls opening into the sides of the furnaces and into the top through the hollow arches constructed at intervals at the top of the furnace, shown in the several plans and sections, are provided to admit heated air into the chambers. This, with the air coming through the ash pits, is designed to aid in the combustion of both the garbage and the gases given off during its drying and burning.

An examination of Fig. 2 will show that the heat from the first, or upper fire, must pass through the drying chamber and take the gases from this chamber down past the lower fire and through the whole length of the incinerating chamber before the chimney flue is reached.

In the middle of November a member of the editorial staff or this journal visited the plant. Garbage, containing little or no ashes, and dead horses were being consumed at the time, and no odors other than those pertaining to the refuse awaiting the fire were noticeable in or about the building.

Regarding the plant and its operation, Mr. Samuel L. Cooper, Commissioner of Public Works for the city of Yonkers, has written us as follows:

> The furnace has been in use continuously since first started, except for about six weeks, due to lack of funds for operation. Last summer a fireman and two laborers were employed. The amount of garbage consumed in summer is about ten large two-horse wagon loads daily, and in winter about six. In summer about two and in winter about one ton of coal is required for fuel. The ashes are not used, except for filling.
>
> The city bought a piece of land about 100 ft. square for the crematory site, paying about $1,000 for it.
>
> The destruction of garbage in our furnace is complete. There is no bad odor when the fire is very hot, but with a low fire there is some.

As to the amount of garbage consumed and the fuel required, Mr. McKay states that from 40 to 60 cu. yds. per day have been burned, with from ¾ to 1½ tons of coal, the average coal consumption being one ton. As many as seven horses have been burned at one time. He estimates that the Yonkers garbage weighs 1,400 to 1,500 lbs. per cu. yd.

The garbage was formerly collected by the city, but Mr. McKay believes it is now collected by a contractor, who also runs the furnace, which was formerly operated by the city.

The plant is located on Nepperham Creek, within the city limits, but in a section not yet built up to a great extent, although streets and building lots have been laid out near by. On Dec. 11, 1894, Mr. McKay was granted patents on this furnace, his claims covering the combination of its various parts, as already described.

ANNUAL REPORT OF THE TRUSTEES OF THE BROOKLYN BRIDGE.

The report for the year ending Dec. 1, 1894, shows that on the bridge cable railway, from Sept. 24, 1883, until Aug. 1, 1893, the number of passengers steadily increased, the number for each month exceeding that of the corresponding month of the preceding year. From this time to Aug. 1, 1894, the condition was reversed, the number of passengers decreasing, but since Aug. 1, 1894, the traffic has again increased at about the same rate as before. During the time that the railway has been in service it has carried 346,589,521 passengers, the highest monthly record being 4,033,920, in October, 1892, which included the week of the Columbian celebration. During the present year the greatest monthly record was 3,845,947 passengers in October, and the greatest daily record 156,403 on March 24, the lowest number being 49,248, on July 22. The ordinary schedule is 529 round train trips per day, made up of three to four cars, according to the time of day and amount of traffic, the headway varying from 1½ to 15 minutes, nearly half the trains being run on the shorter headway. The total time lost during the year by delays from all causes was 2 hrs. 47 mins., of which only 30½% was due to failure of or defect in the cable hauling plant. Failures of the grip occurred only three times. No passenger in transit has been killed on the railway since its opening. Reference is made to the derailment, Aug. 4, by which a car was thrown onto the roadway, which accident was described in our issue of Aug. 9.

Since the railway was put in operation, 11 years 67 days, eight hauling cables have been in use, of which six were worn out and removed before the past year. The service of each cable is shown in the following table:

Service of Cables on the Brooklyn Bridge Cable Railway to Dec. 1, 1894.

Cables in order of service.	State of service.	Term of service, days.	Total distance hauled, miles.	Total passengers hauled.	Total ton-miles hauled.	Av. loads hauled, tons.	Av. ratio of live to dead loads.
No. 1	Out	1,140	228,329	49,002,442	22,142,706	97.0	6.0
" 2	"	607	120,232	47,840,262	25,492,892	212.0	7.3
" 3	"	393	82,099	36,941,884	20,395,073	248.4	7.6
" 4	"	356	74,111	34,134,409	18,923,469	255.3	7.6
" 5	"	520	111,116	56,287,452	33,857,669	304.7	8.3
" 6	"	509	109,475	58,071,052	35,149,894	321.1	8.4
" 7	In use	412	89,540	47,362,156	28,835,389	322.0	8.4
" 8	"	149	32,381	16,939,765	10,480,939	323.7	8.6

Reference is made to the new type of switching engine and the adoption of electric lighting for the cars, which matters have been described in our issues of Dec. 7, 1893, and Nov. 1, 1894. Two more locomotives of the type mentioned have recently been ordered.

The receipts from tolls during the year amounted to $1,111,816 from the railway and $87,268 from the carriageways, or $1,199,084 in all, being $52,824 less than in 1893. The passengers carried by the railway numbered 41,714,235, and the income from this department shows a decrease of $55,682 below that of 1893, while the receipts from the carriageways show an increase of $1,858. Until July 1, tickets for the railway had been sold at 3 cts. each, or 25 cts. for a packet of 10, but since that date two tickets have been sold for 5 cts. The total receipts from all sources amounted to $1,850,142, and the expenditures to $1,521,661, leaving a balance on hand of $328,481. The receipts from rents of land, telegraph wires and the warehouses under the approaches amounted to $116,231.

As to the Liberty St. extension and the Plaza improvement, only one piece of property remains to be acquired. Owing to inability of the city of Brooklyn to supply funds to enable the trustees to take up the award for property acquired, the property was acquired by the Peoples' Trust Co. and leased to the trustees upon payment of the interest upon the amount of the judgment. The completion of the work cannot be accomplished until the necessary funds are supplied by the city. Work has been actively prosecuted on the new terminal station at Brooklyn, and has been commenced on the new station at the New York end. The latter was described in our issue of Nov. 8, and the former will be described in a later issue.

THE FORCE EXERTED BY TORNADOES.

Readers of Engineering News may recall the extended discussion in our correspondence columns during August and September, 1893, regarding the ability of iron bridges to withstand the force of a tornado. The same question was later brought up in connection with the falling of a 553-ft. span of the Louisville & Jeffersonville bridge, under what was claimed to be an extraordinary wind pressure. What actual pressure per square foot may be exerted by a tornado is something concerning which little is known, and yet in view of the rapid increase in steel skeleton buildings of great height, most of them built without wind bracing, it is certainly a matter of much interest to engineers.

Perhaps the best evidence we have of the maximum force exerted by a tornado is the well-authenticated case of the lifting of a locomotive from the rails at East St. Louis some ten or twelve years ago. The locomotive was lifted entirely clean off the rails and set down right side up at one side of the track, so as to make it certain that the force was sufficient actually to lift the locomotive, and not simply to overturn it.

What would happen if a wind of such intensity should strike a modern 10-story or 20-story office

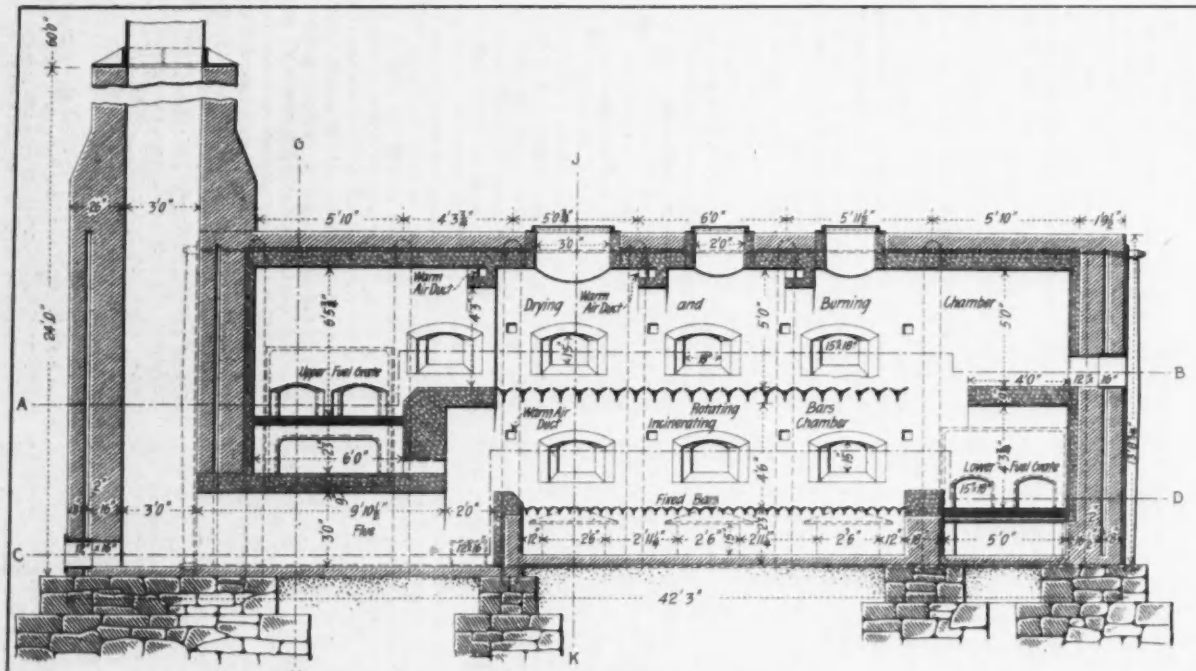


Fig. 2.—Longitudinal Section on Line E F.

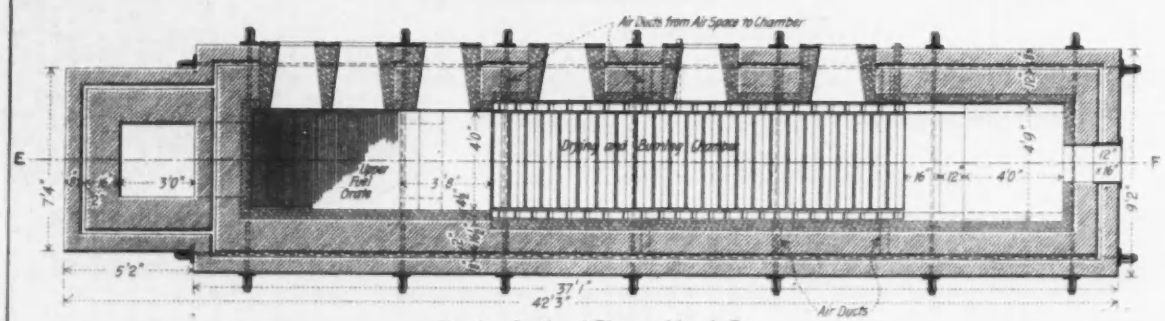


Fig. 3.—Sectional Plan on Line A B.

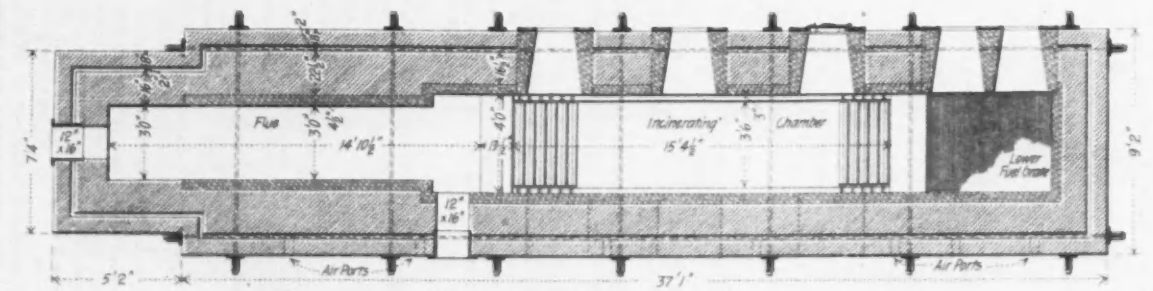


Fig. 4.—Sectional Plan on Line C D.

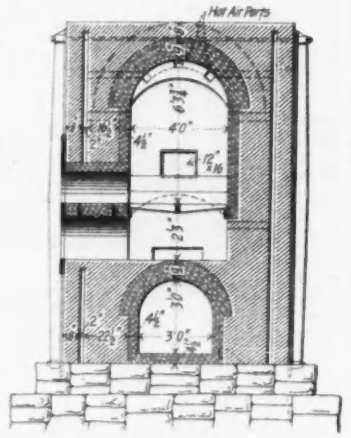


Fig. 5.—Cross-section on Line G. H.

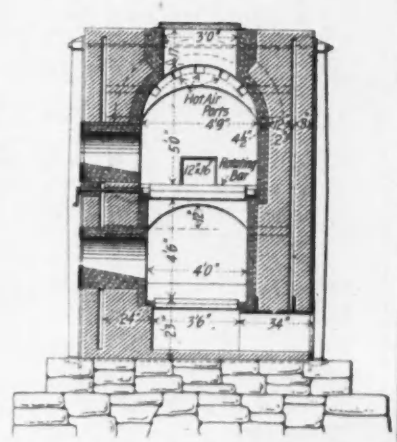


Fig. 6.—Cross-section on Line J. K.

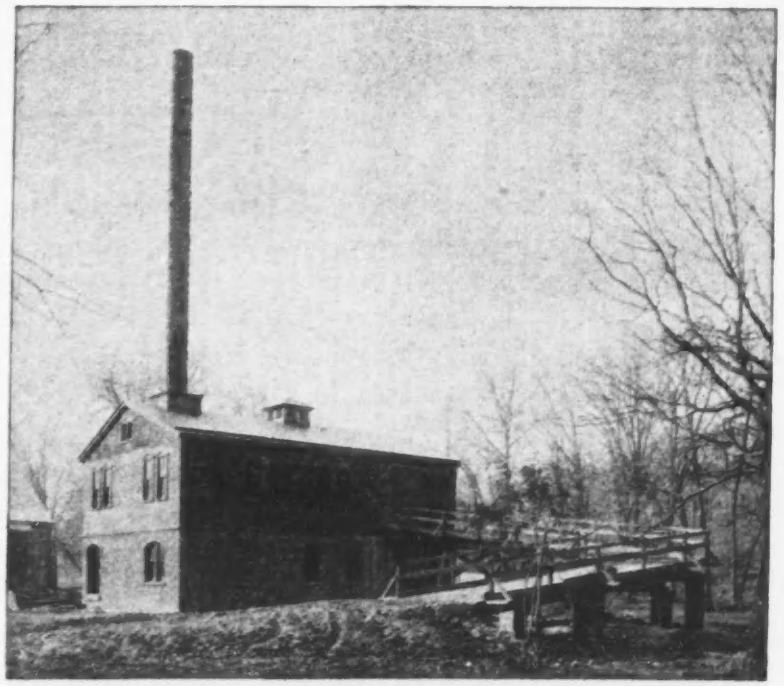


Fig. 1.—View of Building.

The McKay Garbage Crematory, Yonkers, N. Y.;

John E. McKay, M. Am. Soc. C. E., Engineer and Contractor.

ENGR. HART & SONS, LITH., 30 VESEY ST., N. Y.

building we leave our readers to compute on whatever assumptions seem to them reasonable.

It has seemed to us, however, that further instances of the exertion of great lifting force by tornadoes should be collected and recorded; it is only by comparing a large number of such observations that we can obtain some real light on the much-disputed question as to what pressures are usually exerted by tornadoes. Several weeks ago a tornado struck a train on the Missouri Pacific system, near Charleston, Mo., and threw the rear car from the track. We applied to Mr. Jas. W. Way, M. Am. Soc. C. E., Chief Engineer of the Missouri Pacific system, for detailed information respecting the accident, and are indebted to him for the following letter:

Sir: I send you the following copy of the report made by the Superintendent of the Division of the Iron Mountain road, on which the cyclone of Sept. 12 occurred:

The cyclone crossed the track about half a mile west of Charleston, and from a personal interview with the people living in the course of same, they describe it as coming from the south, making a roaring sound and rolling like a large black barrel tossing up and down. It was about 40 ft. wide, and took houses and trees as fast as it came to them; when it reached our right of way on the south side timbers and trees were being carried along with it. It then lowered to the fence and took it all away, and from there bounded to the rear coach of No. 47, throwing the car 30 ft. from the track, the rear coach evidently dragging the balance of the train with it. The force was going upward and did not take our fence on the north side, nor did it come down until it reached a point 200 ft. north, when it again touched the ground, taking large trees and outhouses, and then rose and crossed our Belmont Branch without any damage. The train was running about 18 miles per hour and only ran 30 ft. after being raised from the track. At the point where the derailment occurred, the track was first-class with good sound ties. A large tree struck the side of the rear car, making a large hole. A board was blown through the engine cab window.

From these data, I leave you to draw your own conclusions as to the "wind pressure." I would be very glad, however, to know at what decision you may arrive. These "twisters," as they are called in this country, are very peculiar, and their force is not direct, as you seem to suppose. On the contrary, they have a rotary motion, which is irresistible. Its path was only 40 ft. wide.

Yours truly, James W. Way,
Chief Engineer Mo. Pac. Ry. Co.

St. Louis, Mo., Oct. 19, 1894.

Certainly a force which is capable of picking up a locomotive may be described with considerable accuracy as "irresistible," and a force which catches up a passenger car and throws it 30 ft. from the track might fairly be included in the same category. It may be of interest, however, to roughly estimate the force which may have been exerted on the car. Very few passenger cars weigh less than 85 lbs. per sq. ft. of floor, besides their passengers, and, therefore, to lift such a car off the rails requires nearly twice the pressure (50 lbs. per sq. ft.) which Smeaton ascribes to a "violent hurricane" of 100 miles per hour, "uprooting large trees," even assuming that the upward pressure were evenly applied to the entire lower surface of the car body, which is, of course, impossible. There is also grave room to question whether a merely linear wind motion of 100 miles per hour produces any such pressure as 50 lbs. per sq. ft. on an opposed surface; but there is no reason why the actual velocity of the whirling particles in a "twister" may not be several hundred miles per hour, and much reason to believe that it is as great as this.

Ferrel, in his "Popular Treatise on the Winds," deduces from theoretical considerations a velocity of over 300 miles per hour as probably attained in many tornadoes, and this he concludes represents a force as great as 300 lbs. per sq. ft. Such a force would be ample to lift a car from the track. We note with interest in this connection the treatment of the subject of wind pressure in the report of the Board of U. S. Army Engineers upon the maximum length of span now feasible for great bridges. The conclusion is as follows:

Past history shows the possibility at almost any place of an occasional tornado of power sufficient to destroy almost any existing engineering structure. Such tornadoes, like violent earthquakes, are so rare that no large constructions of to-day are made thoroughly proof against them.

LEGAL DECISIONS OF INTEREST TO ENGINEERS.

Liability of City for Defective Culvert.

Where a city, in lieu of the natural drain of a street, put in a culvert, which it negligently allows to become stopped up, it is liable for damages to property owners whose premises are thereby flooded.—City of Dallas v. Schultz (Ct. of Civ. Apps. of Tex.), 27 S. W. Rep., 292.

Liability of Water Companies for Losses by Fire.

A water company which agrees to furnish water to a city to extinguish fires is not liable to a private person whose property is destroyed by failure to furnish water, as he is not a party to the contract.—Fitch v. Seymour Water Co. (Supr. Ct. of Ind.), 37 N. E. Rep., 982.

Right to Discharge Water Meter Inspector.

The action of the commissioner of city works discharging a meter inspector will not be disturbed on certiorari, where it appears that he, without any apparent reason, reduced the reading of a water meter.—People v. White (Supr. Ct., Gen. Term, 2d Dept.), 30 N. Y. Supp., 163.

Action to Recover Interest Coupons.

The Supreme Court holds, that where bonds issued by a town are void, but the town is liable on an implied contract to repay, with interest, the money advanced thereon, the interest coupons are not sealed instruments, and an action thereon is barred after six years.—Smith v. Town of Greenwich, 30 N. Y. Supp., 156.

Opening Street Across Railway Lands.

The Supreme Court of Illinois holds that the measure of compensation for railway land taken by a city for a street is the decrease in its value for railway use, caused by its use as a street, without reference to such expenditures as the railway company may be obliged to make in complying with the police regulations of the city in regard to street crossings.—Chicago & A. R. Co. v. City of Chicago, 37 N. E. Rep., 1,029.

Validity of Assessment for Street Improvement.

When property owners petition that a street be graveled and graded, at a total cost of about $750, and the street instead is macadamized and guttered, at a cost of $5,359, they are not estopped to deny the validity of the assessment made to pay for the same when, at the commencement of the work, they protested to the city council against the change of plans.—Watkins v. Griffith (Supreme Court of Arkansas), 27 S. W. Rep., 234.

Liability for Failure to Take Bond of Contractors.

The duty imposed by the charter of the city of Duluth upon the board of public works to take a bond for the security of laborers and material men when letting a contract for a public improvement is not a municipal or corporate duty, and the city is not liable for failure to take the bond.—Ink v. City of Duluth (Supreme Ct. of Minnesota), 59 N. W. Rep., 960.

Power of Council in Establishment of Fire Limit.

The common council of Brooklyn, whose only authority under the city charter in regard to the fire limits it to extend them, cannot grant a permit to erect a frame structure within the established fire limits. A permit to erect a frame structure within the fire limits of a city is void, as it is an unjust discrimination between citizens, giving one a right to do that which would be penal if done by another.—City of Brooklyn v. Furey (City Ct. of Brooklyn, Special Term), 30 N. Y. Supp., 349.)

Awarding Contract to Other than Lowest Bidder.

The Common Council of the city of Yonkers awarded a contract for the construction of a sewer to the lowest bidder and the award was vetoed by the Mayor on the ground that this bidder was in controversy with the city over work on another sewer for which he had the contract, and the Common Council had passed a resolution declaring that he had broken his contract. The contractor brought suit, but the Supreme Court of New York decided against him. In his decision Judge Bartlett said: "It is plain in reason and settled by authority that the most favorable bidder is not necessarily the lowest bidder."—(Gilmore v. Utica, 131 N. Y., 26.)

Private Bridges Over Public Alleys.

The Supreme Court of Illinois holds that an ordinance granting to private parties the right to construct for their own use a bridge over a public alley is invalid, since cities hold the fee of the street in trust for public uses only. Where land is platted by the owner into lots, blocks, streets, and alleys, and lots are sold by him with reference to the plat, the purchasers acquire, as appurtenant to the lots, the right to have the adjoining streets and alleys kept clear of obstructions both on and above the ground. Where a proposed obstruction in a public alley inflicts special damage on the owner of an adjoining lot, he is entitled to an injunction restraining its erection.—Field v. Barling, 37 N. E. Rep., 850.

Right of Cities to Purchase Electric Plant.

Section 60 of chapter 19, of the General Statutes of 1889, confers on the council of a city of the second class the right to provide for and regulate the lighting of streets, and under said section the mayor and council have the right to purchase an electric plant for lighting the streets. That clause in the section which authorizes them to make contracts with any person, company or association for such purpose does not restrict them to supplying light by such a contract, but they may, in their discretion, provide lights for the streets and public places, in such a manner as they deem best, provided they do not exceed their powers in incurring obligations or levying taxes.—State v. City of Hiawatha (Sup. Ct. of Kan.), 37 Pac. Rep., 1,119.

Joint Liability for Defective Street Railway Tracks.

Where a street-railway company is under a contract with the city "to construct and keep its railway in such manner and condition as not to prevent the crossing of the streets by teams and wagons at any point with safety," and a person rightfully driving on the street or crossing the track exercises due care, and is injured by reason of the negligence of the railway company in the construction of its track, or in suffering it to become dangerous to travel, and the city permitted the railway to be so constructed as to be dangerous to travel, or had notice or knowledge that the railway was out of repair and dangerous to travel, both the railway company and the city would be liable.—Union St. Ry. Co. v. Stone (Supr. Ct. of Kan.), 37 Pac. Rep., 1012.

A city street railway is liable for injuries caused by the unsafe condition of its tracks, though they were constructed under the supervision of the City Engineer.—Houston City St. Ry. Co. v. Richart (Ct. of Civ. App. of Tex.), 27 S. W. Rep., 920.

Liability of Street Cars for Collision with Carriage.

Where one drove along a street car track and a cable car followed slowly close behind, under perfect control, giving constant signals of its approach, and after passing round a team which had prevented his driving between the track and the sidewalk, turned to leave the track without increasing his speed, and was struck by the car, whether the company's employees were negligent in running too close, or not stopping to give him time to get off, was for the jury. Though the driver was negligent in going on the track, this was not contributory to the accident, and whether he could have left the track more expeditiously and his failure to do so was contributory negligence was a question for the jury. An instruction that if the gripman saw the carriage after it got on the track, in danger of being struck, in time to have stopped the car, and so have avoided the collision, the defense of contributory negligence could not avail, even if the party negligently drove on the track, is erroneous, as requiring a street car to be stopped immediately on a carriage being seen in front of it on the track, though the car was under such control that it could be stopped at any time.—Hicks v. Citizens' Ry. Co. (Supr. Ct. of Mo., Div. No. 1), 27 S. W. Rep., 542.

What Is a Patentable Invention?

A device, in order to be patentable, must be novel, whether it be deemed to be a manufacture or a machine, within the meaning of the patent law, and the test of novelty would seem to be essentially the same in the one instance as in the other. A manufacture is an instrument created by the exercise of mechanical forces, and designed for the production of mechanical effects, but not capable when set in motion, of attaining by its own operation to any predetermined result. It has no inherent law which compels it to perform its functions in a given method, but receives its rule of action from the external source which furnishes its motive power. In this absence of "principle" or "modus operandi" lies the distinction between a manufacture and a machine, the former requiring the constant guidance and control of some separate intelligent agent, the latter operating under the direction of that intelligence with which it was endowed by its inventor when he imposed on it its structural law.

Articles of manufacture may be new in the commercial sense when they are not new in the sense of the patent law. New articles of commerce are not patentable as new manufactures, unless it appears in the given case that the production of the new article involved the exercise of invention or discovery beyond what was necessary to construct the apparatus for its manufacture or production.

An instrument or manufacture which is the result of mechanical skill merely is not patentable. Mechanical skill is one thing, invention is a different thing. Perfection of workmanship, however much it may increase the convenience, extend the use, or dimish the expense, is not patentable. The distinction between mechanical skill, with its conveniences and advantages, and inventive genius, is recognized in all cases. The combination, to be patentable, must produce a different force or effect, or result in the combined forces or processes, from that given by their separate parts. There must be a new result produced by their union. If not so, it is only an aggregation of separate elements. Campbell v. Rayley (Circ. Ct. of App., 7th Circ.), 63 Fed. Rep., 463.

PERSONALS.

Mr. Amos Green has resigned his position as General Manager of the Quincy, Omaha & Kansas City.

Mr. T. R. Atkinson has been appointed Chief Engineer of the Wiscasset & Quebec R. R., with office at Wiscasset, Me.

Mr. A. G. Wells has been appointed General Superintendent of the Atlantic & Pacific R. R., vice Mr. T. R. Gabel, resigned.

Mr. L. E. Johnson has been appointed Superintendent of the Michigan Division of the Lake Shore & Michigan Southern Ry., vice Mr. T. F. Whittlesey.

Mr. Henry Bartlett, Assistant Engineer of Motive Power of the Pennsylvania R. R., has been appointed Superintendent of Motive Power of the Boston & Maine R. R.

Mr. C. C. Burnett has been appointed Assistant Superintendent of the Worcester Division of the Old Colony system of the New York, New Haven & Hartford R. R., with headquarters at Southborough, Mass.

Mr. Frank M. Baker, General Superintendent of the Addison & Pennsylvania R. R., has accepted the position of General Manager of the Darien & Western R. R., now under construction, with offices at Darien, Ga.

Mr. M. F. Bonzano, formerly Superintendent of the New York Division of the Philadelphia & Reading R. R., and later Assistant General Superintendent, has been appointed Assistant Manager of the South Jersey R. R., with headquarters at Cape May, N. J.

Mr. Lewis Nixon, formerly a constructor in the U. S. Navy Department, and later Superintendent of Construction for the Cramp Ship & Engine Building Co., has leased the Crescent shipyard of Samuel L. Moore's Sons, at Elizabeth, N. J., and will undertake the construction of yachts, torpedo boats, etc.

Col. W. P. Craighill, U. S. Engineers, President of the American Society of Civil Engineers, was given a

reception and dinner by Philadelphia members of the society on Dec. 10. Among the members present were Mr. Charles Macdonald, Mr. R. W. Lesley, Mr. John Fritz, Mr. Oberlin Smith, Mr. John C. Trautwine, Jr., Mr. Theodore Voorhees and Mr. James Christie. About 60 persons were present.

Mr. Robert Louis Balfour Stevenson, the famous novelist, whose death is reported at Apia, Samoa, was the son of Thomas Stevenson, an English lighthouse engineer, and the grandson of Robert Stevenson, the builder of the famous Bell Rock lighthouse in 1807-10. Robert Louis Stevenson was himself educated as a civil engineer, but abandoned that profession first for the law and then for literature. He was born at Edinburgh, Nov. 13, 1850. The Robert Stevenson here mentioned should not be confused with Robert Stephenson, the railway engineer and the son of the still more famous engineer, George Stephenson.

NEW PUBLICATIONS.

HYGIENE AND PUBLIC HEALTH. Edited by Thomas Stevenson, M. D., F. R. C. P. Lond., Lecturer on Chemistry and on Medical Jurisprudence at Guy's Hospital, Official Analyst to the Home Office; and Shirley F. Murphy, Medical Officer of Health to the Administrative County of London. Vol. I. Philadelphia: P. Blakiston, Son & Co. 8vo; pp. 1,013; nine plates and 186 figures in the text; $7.50.

The editors state that in securing writers for the volume it was their aim to select men whose names are the best guarantee of the value of their contributions. A few of the names are well and favorably known to American engineers and so far as can be judged from the official positions held by the others and by their work in the book under consideration, all the writers are well qualified to treat the subjects assigned to them.

The two sections of most interest to engineers in this volume are the one on "Water," by Thos. Stevenson, one of the editors, and that on "The Disposal of Refuse," by W. H. Corfield and Louis C. Parkes. Besides these the following subjects are discussed: "Air"; "Warming and Ventilation"; "Meteorology"; "The Influence of Climate on Health"; "The Influence of Soil on Health"; "Food"; "The Inspection of Meat"; "Clothing"; "Physical Education"; "Baths"; "The Dwelling"; "Hospital Hygiene"; "Offensive and Noxious Businesses"; and finally, "Slaughter Houses." Each of these subjects is treated by a separate author. The section on warming and ventilation, the longest in the book, appears to be quite exhaustively treated both from a theoretical and practical point of view. Under meteorology the various instruments used are described and illustrated.

The discussion of water contains much of interest and value, but does not show that familiarity with the literature of this important subject for the past four or five years which one might expect in a work of this sort. Water purification, especially, seems to have been dealt with rather inadequately.

The influence of soil on health is always an interesting subject, when well treated, and one having a wider range of bearing upon other subjects than would be expected until after second thought. In both this section and that on water the bacteriological sides of the question are taken up, including the relation between contaminated soils or waters and certain zymotic diseases.

The construction and operation of baths have from the times of the Romans, at least, demanded the skill of some of the best engineers of the day. The article on this subject, however, refers more to the physiological effects of different baths than to any other phases of the subject, and is not illustrated. The section on the dwelling includes not only houses, but also schools, hospitals, prisons and barracks.

Under "Offensive and Noxious Businesses" and "Slaughter Houses" much is included which might be of service in parts of this country, where rendering establishments and other industries, which give rise to various offenses to the senses, are often suffered to work in their own sweet (?) way with only now and then a remonstrance, or when resisted are opposed too often in an unintelligent manner.

The authors of the section on the "Disposal of Refuse" discuss garbage and other household and street refuse very briefly, and then proceed to give quite an extended treatise on sewerage systems, with especial reference to the sanitary disposal of sewage. Here again, some of the most recent advances made in the field are scarcely touched upon, notably American investigations in sewage purification, but our work here is comparatively recent and time must be allowed for its appreciation outside this country, although it is rapidly gaining recognition throughout the sanitary world.

As a whole the book is very well written and the publishers have brought into one volume what some others might have put into two or three, each perhaps nearly as bulky, at double or treble the price.

CATALOGUE OF THE EXHIBIT OF THE PENNSYLVANIA RAILROAD CO. AT THE WORLD'S COLUMBIAN EXPOSITION. Under the Direction of Theo. N. Ely, Chief of Motive Power, and J. Elfreth Watkins, Special Agent, in Charge of the Exhibit. Published by the Company, Philadelphia, Pa. Cloth; 4to; pp. 158; about 90 plates.

Every visitor to the Columbian Exposition who was interested in railways and engineering will remember the splendid and extensive exhibit made by the Pennsylvania R. R., including important statistical, historical and technical matter. The company erected a building 140 × 40 ft. and the bulk of the exhibits were contained in the main hall, 100 × 40 ft. Outside of the building was a section of standard four-track construction, with signals, signal tower and an overhead bridge, while upon the tracks stood the old "John Bull" locomotive with its train, and the immense cars built to carry the Krupp guns from the seaboard to the exhibition. The exhibit in general was described in our issue of June 1, 1893, and some of the individual exhibits were described in other articles on the Columbian Exposition. The very handsome catalogue just issued by the company contains a complete list of all the exhibits (including models, relics, photographs, drawings, documents, etc.), with brief explanations in many cases. But the most attractive and perhaps the most interesting feature of the book is the collection of plates, of which there are about 48 representing old and modern equipment, and over 40 reproductions of old timetables, tickets, waybills, letters, posters advertising transportation lines, etc. The illustrations of modern equipment include locomotives, passenger and freight cars, a track inspection car, track indicator or dynagraph car, and a twin-screw double-deck ferryboat. Among the documents may be specially noted the bill for the manufacture (in England) of Colonel Stevens' first T-rails for the Camden & Amboy R. R., dated at Cardiff, March 3, 1831, and the letter from the city authorities of Baltimore, dated April 18, 1861, to Mr. Felton, President of the Baltimore & Ohio R. R., recommending that all the troops from the north then in town should be sent back to the border of Maryland as "a measure of absolute necessity." The Pennsylvania R. R. was chartered in 1846, constructed 248 miles of railway prior to Dec. 31, 1853, and at the end of 1892 had 7,980 miles of railway, 3,148 locomotives, 3,364 passenger cars, 122,122 freight cars and 104,021 employees. As the exhibits covered the entire period since the chartering of the road, it will readily be seen what an interesting mass of material was presented. To engineers the large collection of old rail sections, joints and fastenings was particularly interesting. The book is handsomely printed on fine paper, and well bound. The only criticism that can well be made is the omission of a list or index of the illustrations.

NOTES ON GOVERNMENT RAILROADS.—By Arthur Pew, M. Am. Soc. C. E., Macon, Ga. Published by the author. Paper; 8vo; pp. 68. Price, 35 cts.

In this pamphlet Mr. Pew has presented a large number of extracts from books, official documents, etc., of many countries, relative to the results obtained from state ownership and operation of railways, which show that where the railways are both owned and operated by the government, higher rates, poorer service and smaller profits from operation are found than where they are owned and operated by private companies. In regard to Germany, which is generally considered as a bright example of state ownership of railways, it is stated that while the face of the returns shows a profit from the operation, this is only apparent, amounts far in excess of the so-called profit having to be voted annually, while there are great complaints as to the inadequacy of the service. Similar results are shown for the Australian colonies, where enormous expenses and continuous deficits are the rule rather than the exception, while the political trouble has been very great, and, as a daily newspaper remarked: "The only possible remedy is to abolish the state railways, or to abolish the right of railway employees to vote." The statistics given show that America has by far the lowest freight rates, and very nearly the lowest passenger rates, the latter being only higher than some of the third-class rates in eastern Europe and the marvellously low rates of the Indian railways. Various notes are given showing the superiority of private railways. The outcome of the matter presented is crystallized in a verdict that state railway management is inferior to private management both in efficiency and economy.

In this country several states have owned railways, but none of them operate the roads, and most have sold them. Michigan, after some unlucky experiments, has inserted a clause in its constitution prohibiting state ownership. Georgia owns an important railway from Atlanta to Chattanooga, "but the people know by sad experience that the state cannot make it pay expenses, so it is leased to a private company at a large rental." Railway rates are lower and wages higher here than in any European country. Mr. Pew states that two points of growing importance here are the restriction of unnecessary railway construction and the protection of the minority stockholders. He deals also to some extent with the recent arguments put forward in this country for the state ownership of the railways. The work is thoroughly interesting and instructive, and contains much statistical matter, which will be found useful for reference.

THE DEVELOPMENT AND TRANSMISSION OF POWER FROM CENTRAL STATIONS, being the Howard lectures delivered at the Society of Arts in 1893, by Wm. Cawthorne Unwin, F. R. S., etc. London and New York: Longmans, Green & Co 8vo; cloth; pp. 308; 81 illustrations; $3.50.

Few British writers of engineering books are better known to American readers than Prof. Unwin, and this latest book from his pen is upon a subject of such interest that it is certain to be received with favor by the profession. The subject of the book is so broad a one, however, that the discussion has been necessarily somewhat brief. After an introductory chapter on the sources of energy, the author takes up the economy of steam plants, including experiments on engines and boilers, losses of cylinder condensation, advantage of superheating, back pressure, variable loading, regulation of speed, etc. Perhaps the most striking facts brought out in this table are the falling off in efficiency with variable loading, and the great superiority of condensing engines at light loads. Succeeding chapters treat in order of the cost of steam power (the figures of course represent English practice and not American), the storage of energy and water power, including in the latter a very good discussion of the design of turbines.

Chapter VII. is on rope transmission, or "Telodynamic transmission," in the author's language. A curious omission here is that no reference is made to street-car propulsion by cable, which is, perhaps, the most important application of long-distance rope transmission ever made. Systems of high and low-pressure hydraulic transmission as existing in England and on the Continent, and the remarkable system of Ryssel-burgh, at Antwerp, are next taken up.

The two chapters on pneumatic transmission, however, are the "piece de resistance" of the book. We do not just now recall any treatise on air compression, anywhere, which gives so much practical and up-to-date information as the 82 pages of this book which are devoted to this subject. The author is rather profuse in his mathematics, indeed, but for the most part he gives facts and figures from actual practice; in short, just the information which the working engineer desires.

The remaining chapters of the book are devoted to the distribution of steam, the distribution of gas for power purposes, and electrical transmission, with examples of important plants installed on the last-named system.

THE COST OF MANUFACTURES AND THE ADMINISTRATION OF WORKSHOPS, PUBLIC AND PRIVATE. By Capt. Henry Metcalfe, Ordnance Department, U. S. A. Third edition, with Appendix especially illustrating an application of the method in private manufactures. New York: John Wiley & Sons. 8vo; 366 pp.; $5.

We have already made note of the thorough manner in which Capt. Metcalfe here deals with the subjects of the cost of manufacture and the methods by which the multitudinous affairs of the workshop may be more intelligently and systematically handled. Granting the efficiency of effort, the excellence of administration, as the author says, must be measured by the cost. In this work Captain Metcalfe explains how the details representing this cost can be carefully and certainly checked and followed, and the full measure of cost, and also of production, tabulated for analysis in the case of each individual and department. The material for making this analysis and for closely watching cost and production is essential to business success, aside from the simplification of methods and the reductions in records kept by the foreman. The rules here laid down were first applied to the administrative organization of the arsenals of the United States; but with proper modifications they apply to any establishment, and in the appendix the author has shown how this may be done. The system is based upon the separation and close record of the items representing materials, labor, superintendence, plant, tools, attendance, etc. A symbolic nomenclature and system of notation are first adopted, covering all that pertains to the object of manufacture; and the relations of the material to the men inside the shop, and to external agencies, are all fixed. The record of material, time, character and cost of work, and the course of correspondence between the officials, foreman, etc., are all kept by especially prepared cards, filled out by the men responsible at the different stages of the work, and at the time the work is done. This system, which must be studied to be fully appreciated, is supplemented by methods of analyzing cost, the shop-order system of accounts, and a full detail of the appliances required for carrying out the methods here proposed, such as punches, stamps, racks, pigeonholes, trays, post-office, etc. The duties of the stock and cost clerk are also fully explained.

PUBLIC WORKS.—A Treatise on Subjects of Interest to Municipal Officers. By Edward McCullough, C. E. Pamphlet, pp. 54. Published by the author, 511 California St., San Francisco, Cal. 25 cts.

The author of this treatise here briefly discusses from the engineer's standpoint, the various problems with which town trustees, or the municipal officers of smaller towns, have to deal. Under the head of streets he treats of grades, cross-sections and materials, giving rules for general guidance as laid down by the best practice for varying conditions; makes out a list of road-making plant which the town should own, and concludes with a statement of prevailing San Francisco prices for materials in 1894. The next chapter is devoted to health and cleanliness; then come the questions of drainage and sewerage, sizes of sewers, materials, connections, ventilation and methods of disposal. Water supply is taken up in the fourth chapter. The sources are discussed and an estimate of cost of plant is given for a town of from 1,000 to 3,500 inhabitants. The attention of town officers is called to the importance of surveys, working maps and complete and well-kept records of public performed. Contracts and work by the city form the next subject, and the author strongly recommends advertising for plans for sewers, etc., and the selection of a competent consulting engineer to decide upon the merits of plans submitted. The concluding chapters are devoted to a discussion of municipal ownership, pointing out where public plants can be profitably conducted by the town authorities, under capable and honest management, and other cases where prevailing conditions make private ownership more expedient. Mr. McCullough puts the case in a nutshell when he says that "in a private company an employee's value is rated by his earning capacity, while in a municipality it often happens that a man's fitness for the position he holds is apt to be gaged by his usefulness at election time." The last chapter relates to town bonds, their sale, redemption, etc. This little book is well calculated to do good service among the officials to whom it is directed. It calls their attention, in a plain and simple manner, to many things of which they know little or nothing; but of which the honest and well-intentioned official will be glad to know. From an engineering standpoint, it attacks the subject in the right direction, in attempting to instruct and enlighten those who employ, or should employ, engineers.

LETTERING OF WORKING DRAWINGS. By J. C. L. Fish, Assistant Professor of Civil Engineering in Stanford University, California. New York: D. Van Nostrand Co. Oblong 4to, 9 × 12½ ins.; boards, cloth back; pp. 38; 13 full-page plates; $1.

We understand that this work was undertaken at the suggestion of Prof. C. B. Wing, of Stanford University, whose little work bearing practically the same title has been for some time out of print. The great value of this book lies in the fact that the plates form the best collection of styles of lettering suitable for freehand drawing that has, in our knowledge, yet been published. The originals from which this collection was compiled were procured by correspondence with a large number of the principal drafting offices in this country, and the author has apparently shown good sense in his choice of those most suitable for his purpose. The best chapter in the text treats of "Titles." The instructions for forming the letters are open to much criticism. We do not believe that a fair-looking "O," either gothic or roman, was ever made freehand by a single stroke of the pen in an anti-clockwise direction; the two lobes of a pleasing "B" are not equal, nor does a symmetrical "W" consist of two "V's" placed side by side. It is fortunate for the author that, in making the excellent plates of examples, he has evidently ignored his own instructions.

DIE MASCHINEN ELEMENTE. Their calculation and construction with reference to new experiments. By C. Bach, Professor of Mechanical Engineering at the Imperial High School of Stuttgart. Stuttgart: The J. J. Cotta Co. Large 8vo; paper; pp. 610; 411 cuts; many tables, and 45 lithographic plates.

The first 75 pages of this volume are devoted to the theory of elasticity and strength, being an abstract from the author's own book on these subjects; then follows a most complete presentation and analysis of the various elements in machinery construction, beginning with a description of loose and fixed connections, and extending through the subjects of wheel gearing, rope and belt transmissions, trunnions, shafts, couplings, bearings, pistons, boxes, cranks, rods and guides. An appendix contains the usual mathematical tables, printed in uncommonly large and clear type.

ELASTICITAT UND FESTIGKEIT. By C. Bach, Professor of Mechanical Engineering at the Imperial High School of Stuttgart. Berlin: J. Springer. 8vo; cloth; pp. 432; 219 cuts and 14 half-tone plates.

This book presents in a form well adapted to the requirements of the student a comprehensive investigation of the important phenomena of elasticity and strength. The work is divided into seven parts; the first two, which include over half the volume, being a treatise on the subjects of tension, simple compression, bending, compression of columns, torsion and shear. The relation of time, form and the manner of application of the load to the results produced is investigated in connection with the laws governing these stresses. The third part contains a discussion of the work performed by the body in changing its form. Part IV. treats of the combined influences of some of these stresses; and in Part V. their action upon bodies of single and double curvature is considered; the bent hook, the roll and the spring being notable examples. In the sixth part, the interior and exterior pressures upon the walls of hollow cylinders and spheres are analyzed, while the concluding part treats of the influence of stress upon quadratic, circular and elliptical planes.

STATE BOARD OF HEALTH OF CALIFORNIA: Report for the Fiscal Years from June 30, 1892, to June 30, 1894; also the Transactions of the Second Annual Sanitary Convention held at San Jose, April 16, 1894. Sacramento: Published for the Board. Address J. R. Laine, M. D., Secretary, San Francisco. 8vo; paper; pp. 344.

There are brief papers in this report on "Sewage Irrigation," by H. S. Orme, M. D., and "The Ultimate Disposal of Sewage," by J. H. Stallard, M. D., each writer favoring disposal of sewage on land. A paper of some 35 pages on "Water in Relation to Health and Disease," by Dr. G. M. Kober, is also included. These papers deal mostly with facts well known to engineers. The paper on water deals very unsatisfactorily with water purification, the writer apparently being unacquainted with recent advances in this field.

THEORETICAL MECHANICS—An Elementary Treatise on. By Alexander Ziwet, Assistant Professor of Mathematics in the University of Michigan. Part III. Kinetics. New York: Macmillan & Co. 8vo; pp. 256; with many diagrams; $2.25.

This new text-book, the third in the series, by the same author, takes up the study of the kinetics of a particle and the kinetics of a rigid body, devoting about equal space to each. In treating the first part of the subject, the methods of such recent writers as Budde and Appell have been followed, in the belief that the student will be made to thus more readily understand the use of these methods in the general case of the motion of a system, treated in the latter part of the volume. For an elementary study of this branch of dynamics the work is well designed; it is as simple in its treatment as the subject will permit, with frequent references to authorities and the literature necessary for a broader study of the theory of impulsive forces.

U. S. COAST AND GEODETIC SURVEY. Report for year ending June 30, 1892. Part II. Appendices relating to the methods, discussions and results of the Coast and Geodetic Survey. Washington, D. C., 8vo; 552 pp.; many maps and diagrams.

This report treats of methods and results in determining variations of latitude at Rockville, Md., and at Waikiki, Hawaiian Islands; results of geodetic spirit leveling at various places, with record of bench-marks; observations on tidal currents; changes in coast lines in New England, from 1846 to 1891, etc. There is a full illustrated description of the iced-bar base apparatus and its application to the measurement of base lines; also of the metallic tape base apparatus, with full records of work performed by them.

PROCEEDINGS OF THE AMERICAN FORESTRY ASSOCIATION. Published by the Association. Secy., N. H. Egleston, Washington, D. C. Paper; 8vo; pp. 44.

This contains the proceedings of the tenth, eleventh and twelfth annual meetings, held at Washington in December, 1891, 1892 and 1893, together with the proceedings of the meeting held in Chicago Oct. 18 and 19, 1893, in connection with the World's Congress Auxiliary of the Columbian Exposition. There is an interesting paper by Mr. B. E. Fernow on "Forest Conditions and Forestry Problems in the United States," and an address by Mr. John Noble, ex-Secretary of the Interior on "Our National Parks and Timber Reservations; Their Importance and Proper Administration."

THE ARCHITECTS' DIRECTORY. Containing a List of the Architects in the United States and Canada. Published by William T. Comstock, 23 Warren St., New York, and 260 Dearborn St., Chicago. Paper; 12mo; pp. 119; price $1.

The list of architects is classified alphabetically by states and towns, and the names are given of the architectural associations to which the persons named belong. There is also a selected list of manufacturers of and dealers in building materials and appliances, classified alphabetically by trades. The directory has been prepared with great care to ensure accuracy, and has a wide range of usefulness.

REPORT OF THE TRUSTEES OF THE NEW YORK AND BROOKLYN BRIDGE FOR THE YEAR ENDING DEC. 1, 1894.—Issued by the Trustees, President, James Howell, Brooklyn, N. Y. 8vo; pp. 19.

Some of the information and statistics from this report are given in another column.

TRADE PUBLICATIONS.

PUMPING MACHINERY. Catalogue 19 of Dean Brothers Steam Pump Works, Indianapolis, Ind. Paper; pp. 134.

The half-tone and line engravings in this catalogue, together with the text, show up in detail the many kinds of pumps made by this firm. Several useful tables are given at the end of the catalogue.

SOCIETY PROCEEDINGS.

WESTERN SOCIETY OF ENGINEERS.—The canvass of the letter ballot on the proposition to withdraw from the Association of Engineering Societies was made at the meeting of Dec. 5. There were 70 votes in favor of withdrawal and 137 against it.

NEW ENGLAND WATER-WORKS ASSOCIATION. The regular quarterly meeting of the association was held at Young's Hotel, Boston, on Dec. 12. Lunch was served at 1 p. m., after which the meeting was called to order by the president, Mr. Geo. A. Stacy, Superintendent of the water-works at Marlboro, Mass. A paper was read by Mr. Allen Hazen, entitled "Notes on European Water Supplies." The same paper was presented at the meeting of the Boston Society of Civil Engineers, on Nov. 21, and its main points were given in our issue of Nov. 29.

AMERICAN FORESTRY ASSOCIATION.—The 13th annual meeting will be held in Washington, D. C., on Friday, Dec. 28, at the Department of Agriculture. The meeting will be called to order at 10 a. m., for the purpose of hearing reports of the past year, electing officers, and transacting other business. At 8 p. m. a joint meeting will be held with the National Geographic Society to listen to an address by Prof. N. S. Shaler, of Harvard University, upon "The Economic Aspects of Erosion," the subject having an immediate interest as relating to the removal of soil after deforestation.

B. E. Fernow, Chairman Executive Committee.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—Some of the Chicago members of the Society apparently think the pending election needs enlivening by a contest, and a number of them have nominated Mr. J. F. Wallace, Chief Engineer of the Illinois Central R. R., as an opposition candidate for the office of President. We have also received an anonymous circular from Chicago enclosing ballots for Mr. Alphonse Fteley of New York city, Chief Engineer of the Croton Aqueduct Commission, for the same office. The parties sending out this circular take pains to state, however, that they have used Mr. Fteley's name without his consent. The regular candidate for the office, as announced some time ago, is Mr. Geo. F. Morison, of Chicago.

COMING TECHNICAL MEETINGS.

FRANKLIN INSTITUTE, PHILADELPHIA.
Dec. 21, "Improvement of Delaware River and Harbor," by L. Y. Schermerhorn. Secy., W. H. Wahl.
ENGINEERS' CLUB OF INDIANAPOLIS.
Dec. 22. Secy., C. C. Brown.
ENGINEERS' CLUB OF ST. LOUIS.
Jan. 2. Secy., W. H. Bryan, Turner Block.
AMERICAN SOCIETY OF CIVIL ENGINEERS.
Jan. 2. "Bridge over the Tennessee River at Johnsonville, Tenn.," by Hunter McDonald. Secy., Francis Collingwood, 127 E. 23d St., New York.
CANADIAN SOCIETY OF CIVIL ENGINEERS.
Jan. 3. Secy., C. H. McLeod, 112 Mansfield St., Montreal.
WESTERN SOCIETY OF ENGINEERS.
Jan. 2. Secy., Thomas Appleton, Lakeside Bldg., Chicago.
TECHNICAL SOCIETY OF THE PACIFIC COAST.
Jan. 4. Secy., O. Van Geldern, 719 Market St., San Francisco.
ENGINEERS' CLUB OF PHILADELPHIA.
Jan. 5. Secy., L. F. Rondinella, 1122 Girard St.
CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
Jan. 7. Secy., C. L. Annan, City Engineer's Office.
CIVIL ENGINEERS' CLUB OF CLEVELAND.
Jan. 8. Secy., F. C. Osborn, 721 Hickox Building.
NORTHWESTERN SOCIETY OF ENGINEERS.
Jan. 8. Secy., D. W. McNorris, Burke Building, Seattle, Wash.
NORTHWESTERN RAILWAY CLUB.
Jan. 8. Secy., W. D. Crosman, Ryan Hotel, St. Paul.
DENVER SOCIETY OF CIVIL ENGINEERS.
Jan. 8. Secy., F. Ed. King, 36 Jacobson Block.
NEW ENGLAND RAILROAD CLUB.
Jan. 9. Secy., F. M. Curtis, P. O. Box, 1576, Boston, Mass.
ENGINEERS & ARCHITECTS' CLUB OF LOUISVILLE.
Jan. 10. Secy., G. W. Shaw, Norton Building.
ENGINEERING ASSOCIATION OF THE SOUTH.
Jan. 10. Secy., Hunter McDonald, Nashville, Tenn.
NORTHWESTERN TRACK AND BRIDGE ASSOCIATION.
Jan. 11. Secy., D. W. Meeker, St. Paul, Minn.
MONTANA SOCIETY OF CIVIL ENGINEERS.
Jan. 12. Secy., G. O. Foss, Helena, Mont.
WISCONSIN POLYTECHNIC SOCIETY.
Jan. 14. Secy., Geo. G. Mason, 144 8th St., Milwaukee.
ENGINEERS' CLUB OF KANSAS CITY.
Jan. 14. Secy., F. W. Tuttle, Baird Building.
CENTRAL RAILWAY CLUB.
Jan. 13. Secy., S. W. Spear, East Buffalo Iron Works, Buffalo, N. Y.
MICHIGAN ENGINEERING SOCIETY.
Jan. 15, 16, 17. Annual convention at Lansing, Mich. Secy., F. Hodgman, Climax, Mich.
COLUMBIAN ENGINEERING SOCIETY.
Jan. 15. Secy., W. F. Hart, Washington, D. C.
WESTERN RAILWAY CLUB.
Jan 15. Secy., W. D. Crosman, Rookery Building.
ASSOCIATION OF ENGINEERS OF VIRGINIA.
Jan. 16. Secy., J. H. Pilcher, Roanoke, Va.
NEW YORK RAILROAD CLUB.
Jan. 17. Secy., John A. Hill, Temple Court, N. Y. City.
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
Jan. 17. Secy., D. Carhart, Carnegie Library Building, Allegheny.
ENGINEERS' CLUB OF CINCINNATI.
Jan. 17. Secy., J. F. Wilson, 24 W. 4th St.
SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.
Jan. 17, Atlanta, Ga., Secy., F. A. Charpiot, Macon, Ga.
ENGINEERS' CLUB OF MINNEAPOLIS.
Jan. 21. Secy., E. Nexsen, Kasota Block.
BOSTON SOCIETY OF CIVIL ENGINEERS.
Jan. 23, Secy., S. E. Tinkham, 36 Bromfield St.

ENGINEERING NEWS
AND
AMERICAN RAILWAY JOURNAL.

Published Weekly at Tribune Building, New York.
Entered at the Post Office, New York, as Second Class Matter.

VOL. XXXII. THURSDAY, DEC 20, 1894.

M. McN. STAUFFER, A. M. WELLINGTON.....EDITORS.
CHAS. W. BAKER, E. E. R. TRATMAN, H. N. BAKER,.....ASSOCIATE EDITORS
GEO. H. FROST.....BUSINESS MANAGER.
C. P. BURT.....ASSISTANT MANAGER

CHICAGO OFFICE: 1,636 The Monadnock.
CHAS. S. HILL.....RESIDENT EDITOR
H. A. PECKHAM.....ADVERTISING MANAGER

EUROPEAN AGENCIES:
KEGAN PAUL, TRENCH, TRUEBNER & Co. (Limited), Paternoster House, Charing Cross Road, London, Eng.
SAMPSON LOW, MARSTON & Co. (Limited), St. Dunstan's House Fetter Lane, London, Eng.

SUBSCRIPTION RATES: United States, Canada and Mexico, One Year, $5.00; 6 months, $2.50; 2 months, $1.00; single copies, 15 cents. To all other countries in the Postal Union, add $2.08 per annum (4 cents per number) to above rates for postage. No club rates allowed. Mailing addresses may be changed at will by sending both old and new address. We shall be obliged if subscribers who fail to receive their papers promptly will notify us without delay.

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ADVERTISING RATES: 20 cents per line agate measure. Want notices, special rates, see page 22. Rates for standing advertisements sent on request. Changes of advertisements must be in hand on Monday afternoon; new advertisements, Tuesday afternoon; transient advertisements by Wednesday noon.

In view of the amount of talk concerning the potential earning powers of a North River bridge, it is interesting to note what is the actual earning power of the East River bridge, according to the current report of the trustees, an abstract of which is given in another column. We learn that in round numbers the bridge earned $1,200,000 during the past year and expended about $700,000 on pay rolls and salaries, and about $80,000 for materials and supplies. If a bridge from Brooklyn, with its population of nearly 1,000,000, and landing its passengers close to the down-town office-building district, nets less than a half-million a year from 41,000,000 passengers, the query comes, what profits a bridge from New Jersey, landing passengers from two to five miles from the down-town office district, could hope to make on its passenger traffic?

The announcement that the Bethlehem Iron Company has secured a contract from the Russian Government for making armor plate, in competition with the most prominent European makers of armor, marks a new and important departure for American manufacturers. That an industry which did not exist in this country less than a decade ago should have, in this short period, created such a plant and so perfected its methods as to successfully compete with long-established European workshops, is an achievement which speaks volumes as to the merit of American energy, mechanical skill and inventive genius. The daily press reports have greatly exaggerated the amount of armor and the money involved, but the very fact that such a contract should be secured by an American firm is a fact of much more importance than the amount involved in the contract. We are able to state authoritatively that the contract just awarded to the Bethlehem Co. is for the 16-in. side-belt armor of the two Russian battle-ships "Sebastopol" and "Petropavlovsk," amounting to about 1,200 tons, and not 12,000 tons, as the press reports had it. This armor will be nickel-steel, Harveyized; but the price at which the contract was secured is as yet unknown here, notwithstanding the figures given by the press and the comments founded upon these figures as to the cheapness of American armor when competing abroad.

The commercial aspect of forest preservation is not as generally understood as it should be, the common impression being that such preservation means the prohibition of all cutting of timber, and the consequent injury of the lumber interests. Such a view was taken by the framers of the amendment to the New York State constitution (passed at the last election) providing for the protection of the Adirondacks by forbidding the cutting of any timber. One of the most difficult tasks of the Forestry Division of the U. S. Department of Agriculture has been to educate people to understand that trees are as much a crop as grain, and to be planted, grown, and cut down for use when ripe in the same way. It is hardly necessary to point out here the excellent financial results that have been obtained in other countries, especially Germany and India, by a proper system of forest management under government supervision. At the meeting of the American Forestry Association in Brooklyn, in August last, a resolution was adopted expressing approval of the efforts made by the Public Lands Committee of the House of Representatives for the enactment of a law providing not only for the care and protection, but also for the rational use of the timber and other resources in the forest reservations and on all public timber lands, as the policy of reserving the timber should be only preliminary to the intelligent and efficient administration of these reservations. The mere exclusion from use of large territories and the resources contained therein does not effect the desired result, and if the reserved timber is not cared for by the government there is likely to be as great destruction and depredation as before the government assumed any control. The American Society for the Advancement of Science has also taken the matter up, and expressed its conviction that the necessity for a thorough system of protection of the public forests "against destruction by fire, by ravages of sheep, and by the injudicious use of the axe," has become imperative, such protection being demanded not only in the interest of our rapidly diminishing lumber resources, but also for the conservation of equable water supply and for the irrigation of reclaimable arid regions. Also that while the policy of reserving public timber lands for forest purposes is a step in the right direction, it must fail to accomplish its object and lose its value unless a proper administration of the reserves is at the same time inaugurated, such administration providing not only for protection against depredations, but also for the reproduction of the timber on the same, and for the rational use of all the resources contained in them.

A bill "to protect forest reservations" (House Bill No. 119) has been recommended by the Public Lands Committee for enactment, and it is hoped that the bill may be passed during the present session. The protection of the reservations (now comprising nearly 18,000,000 acres) is sought by the employment of the army, which has already done such effective work in the Yellowstone Park and Yosemite reservations. The bill empowers the Secretary of the Interior to make such rules and regulations and establish such service as will insure the objects of the reservation, namely, to regulate their occupancy, to utilize the timber of commercial value, and to preserve the forest cover from destruction. It also empowers him to have cut and to sell timber on non-reserved public timber lands under the same regulations as made for the forest reservations, provided that it shall first be shown that such cutting will not be injurious to the public interests. The proceeds are to be expended in the care and management of such reservations, making them self-supporting. While this bill does not satisfy the ultimate requirements of a well-organized forestry department such as this country now needs, it may be considered as a first step toward such organization, and recommends itself by its simplicity and immediate practicability, leaving the details of methods to the executive department, which has indorsed the bill. This legislation has received the specific approval of the Secretary of Agriculture in his report for 1893, and of the Secretary of the Interior, as it gives a legal status to and insures the permanence of the principle of the forest reservations, while it also provides for a regulated use of the public timber. It has been proposed that in order to train army officers for such duties as may be assigned to them in connection with the forest reserves, a chair of forestry should be established at the West Point Military Academy, an excellent suggestion, which is somewhat in the line of the organization of the forestry department of India.

There has recently come into our hands a copy of a typewritten circular letter, sent out by the Committee on Viaducts of the City Council of Milwaukee, which seems to demand some comment in these columns. This letter, from its form, was apparently sent out to a number of chief engineers of railways, and to other prominent engineers, and it asks the cost of various kinds of oak planking, requests advice upon the use of long-leaf yellow pine and its cost, and finally queries as to the best lumber to be used and the thickness, material and best manner of laying a wood pavement upon "a large viaduct." One of these letters was sent to Mr. John F. Wallace, Chief Engineer of the Illinois Central R. R., who very properly replied to the effect that, if the signers wished to obtain professional advice, they should seek it in a proper manner, by employing an engineer to investigate and report.

The idea is altogether too prevalent among city officials that by gathering information in some similar manner to the above, they are doing a service to their constituents, in saving the fees of a consulting engineer. They may save the fees; but it by no means follows that they will secure valuable information by this method, or that it is the best for the city's interests.

We happen to know, moreover, what was probably known to few of the engineers who received the letter sent out by the Milwaukee committee, that this information was not sought merely as an aid in estimating or designing a structure to be erected, but was desired in the committee's investigation of the work done by the engineer who had charge of the viaduct in question. Upon this structure, recently completed for the city, yellow pine was substituted for floor planking in place of oak, which the specifications required. The substitution was made with the knowledge and full approval of the engineer in charge, and it is stated that at the market prices the change was of no importance to the contractor, and was considered by the engineer to be a benefit rather than an injury to the structure. Certain city officials, however, were bound to sift the matter to the bottom, and they, therefore, sent out the circular letter above referred to.

Of course, no valid objection can be made on general principles to their desire to investigate the matter more fully. If the report of their engineer did not satisfy them, it was their duty to investigate further. What is objectionable is the manner in which they set about this. If an attorney employed on city business gave them advice which they were doubtful about accepting, would they send circular letters to a lot of prominent lawyers, asking their opinion in the matter? Certainly not; they would lay the case before some attorney, in whom they had confidence, and ask him to investigate the matter and report his conclusions.

Why should they not pursue the same course when a question of engineering is concerned? Simply because some engineers set so small value on their professional opinions that they will answer in good faith questions put in such a letter as that described above. We venture to say that no reputable attorney would freely give an opinion on a professional matter, in response to a circular letter; and if engineers would have equal recognition as a profession, they must have equal respect for themselves and their profession. We do not know how much satisfaction the Milwaukee committee received, in reply to its circular letters, but we sincerely hope that all the engineers whom it addressed were as wise as Mr. Wallace in treating the inquiry according to its deserts. If this was the case, the Milwaukee committee is doubtless wiser on some points, than it once was, even though it has not gained the information which it set out to sponge.

THE WRONG WAY TO CONDUCT CITY ENGINEERING.

The city of San Francisco, the oldest on the Pacific Coast, and with about 300,000 inhabitants and 48 square miles of territory, has succeeded in spending $29,000,000 on its streets, sewers, and other public works, without the expense or interference of an engineering department in its municipal organization. What this administrative "economy" has really cost the people of that city can only be guessed at; but an approximate idea may be gained from the contents of an official document now before us. This is a progress report made to the Board of Supervisors of San Francisco by Messrs. Marsden Manson, M. Am. Soc. C. E., and C. E. Grunsky, two engineers of reputation and wide experience, who were appointed to report upon a plan for providing the city with a system of sewers. San Francisco now has about 250 miles of drains and sewers put in, at a cost of nearly $6,000,000; but it has no system of drainage, and it is to supply this want that this board was organized.

It is interesting, as an object lesson in pointing out the wrong way of conducting municipal public works, to follow out the past practice in San Francisco and set down a few of the results as gleaned from this report. In the first place, the Superintendent of Streets, an official elected by popular vote, is there charged with the responsible duties usually performed by a City Engineer. This officer has charge of the construction of streets, sewers, and other public works; under his rule have been expended the $29,000,000 referred to, and the same officer, for the system still exists, is now spending annually $1,500,000 on similar work. How well this political place-holder is fitted to devise and control engineering construction, which the law says must be done under his direction and to his satisfaction, can be guessed at from a glance over the list of men who have filled that office since 1863. This list forms part of a campaign document issued during the late lively municipal campaign, which has resulted in the election of Mr. Adolf Sutro as Mayor by an overwhelming vote of the reform party. We find in this list an undertaker, several bricklayers, three custom house inspectors, a teamster, a hotel-keeper, a marble cutter, a contractor—in fact, anything but a civil engineer, or a man fitted by any previous experience to perform an engineer's duties.

Returning to the report, we find just such a disgraceful record of administrative abuse of office and neglect of duty as should be expected where the incumbent is selected because of his political powers only, and where his fitness for the office is of the least consideration, if considered at all. This report treats only of the sewers of the city, and the method of proceeding seems to have been about as follows: The duty of preparing plans and specifications for the sewers required from time to time fell upon the City and County Surveyor, who prescribed gradients and was supposed to exercise control over lines and grades. But all supervision of construction came under the office of Superintendent of Streets. The actual working of this method can be gathered from the report, and the wretched work performed under this divided and ignorant control. The City Surveyor is paid by fees fixed by ordinance, and all surveys are made at his personal expense, and it is natural to suppose that this expense was kept down as much as possible. In fact, the chief instruction issued for the guidance of the contractor was a time-honored legend appended to all sewer diagrams, directing the contractor to conform to street grades and curbs for line and grade, and to place the sewer "10 ft. below street grades, if connections will allow." Working under these weird instructions, and without inspectors, the contractor had a wide range of latitude in carrying out his work, and in supplying material. When the sewer was completed the City Surveyor was required to certify to its fulfillment of contract specifications; but as the seemingly well-established practice of inspection was merely to measure down the man-holes only for a test of depth below street grade, the "privileges" of the acute contractor were little interfered with.

In making their report, Messrs. Manson and Grunsky naturally sought to find how much of the present network of drains and sewers could be utilized in a new and well-devised system of drainage, and they also examined closely into the condition of existing sewers. What they found in this latter quest is told in full detail and with convincing photographic illustrations. Space is wanting for a full exhibit of these, but some few may be selected. On one street a 14-in. pipe sewer was built, certified to, and accepted, and paid for by the property owners as "a 16-in. sewer." The engineers uncovered this sewer and found that at places it was only 3 ft. below street grade, instead of the "10 ft." specified as usual, and it did not average 4 ft. below grade. Moreover, the gradient was so irregular that in places the bell and spigot of the pipe did not even meet at the top of the joint; no mortar was used, excepting a little dab at the top and bottom; only one-tenth of the prescribed house connections were in place, and no ladders were fixed in the man-holes, as ordered and paid for. As a sewer, it might just as well never have existed.

In another case, a 3×5-ft. sewer was so constructed that its bottom was 2½ ft. higher than the similar sewer with which it connected and which was to serve as its outlet. The area at the connection was contracted to less than half that of the normal sewer; but the upper half of the higher sewer was boarded up and there it has been for 12 years. Other 5-ft. circular and 4×5-ft. sewers were ordered to be placed on a concrete base resting on two layers of 3-in. planking crossed. The inspecting engineers found these sewers bedded in the soil, without concrete or platform; though, in some cases, a 2-in. plank was put down in place of the two 3-in. planks, and a little concrete was used in an utterly insufficient manner. In one district, in the heart of San Francisco, covering about 1-5th of the area of the built-up city, 139 storm-water inlets, or catch-basins, were found that were absolutely useless, as the gutters sloped both ways away from them. At $90 apiece, these represented a waste of $12,510, on this single item, in this one section of the city. And they were not only a waste of public money, but a constant menace to public health, for as water could not reach them, even during rainstorms, they were never trapped and were actually so many outlets for sewer-gas.

The specifications under which this sewer work was performed are indefinite, unintelligible and antiquated, being merely handed down from one superintendent to another through many administrations. Unaccompanied by proper plans of record, and without engineering design and supervision, or adequate inspection during construction or on completion, it is little wonder that bad and fraudulent work and a waste of public funds resulted therefrom. The wonder is that any fairly good work exists at all; and the record does not seem to indicate that there is much coming under that classification. There seems to have been absolutely no intelligent check upon any amount of rascality and absolutely no honest effort to prevent such rascality. The report referred to deals with sewers alone; but as the streets, etc., costing over three times as many millions as the sewers in the last 30 years, were constructed under the same superintendents, it is fair to presume that the same methods prevailed. Little better proof is needed of this assumption than the notoriously bad condition of the bulk of the highways of San Francisco.

As the proper conduct of a City Engineer's office is just now attracting more general attention than ever before, considerable space has been devoted to here detailing what it eventually costs the tax-payers to do without any such department. In this respect, and among cities of its importance, it is gratifying to note that San Francisco is a marked exception to the general rule. But many other cities yet have an organization that, while nominally acknowledging the existence of a City Engineer, places him under the control of men of the same type as the superintendents of streets in San Francisco, and similar if not equally bad results may be expected. That the management of the public works of a city is "business and not politics" cannot be better illustrated than by the Pacific Coast example, here commented upon. The lack of business principles, in not putting this $30,000,000 worth of streets and sewers under honest and competent supervision, is now likely to cost the citizens of San Francisco many further millions to obtain what they might now possess and enjoy.

It is encouraging to see, however, that the people of San Francisco have at last awakened to the absurdity and iniquity of past practice, and the results of the late municipal election promise, at least, an era of better and more intelligent rule. The election of so aggressive, broad-minded and public-spirited a man as Adolf Sutro for Mayor, and the choosing of 10 out of the 12 Freeholders, who have before them the duty of framing a new charter for the city, certainly should result in an organization more fitting to the times and to the rank of San Francisco among American cities. The non-partisan, or reform, party failed to elect their candidate for Superintendent of Streets, a reputable and experienced civil engineer, but they have made a beginning in nominating an engineer to perform an engineer's duties, and this is a most marked advance upon previously prevailing methods, and points out the path in which the framers of the new charter should follow, if they really mean "business," not politics, this time.

LETTERS TO THE EDITOR.

THE ONTARIO MINE DRAINAGE WORKS.—CORRECTION.

Sir: In printing my paper with the above title in your issue of Nov. 29 some errors have been incorporated which should be corrected as a matter of record. The Ontario mine is in the Uinta mining district. The first drainage tunnel was 1 1-12 miles (5,720 ft.) not 1½ miles. In driving the long tunnel the trouble with bad ground, caving, etc., was experienced in the first 14,600 ft. of the tunnel driven, as fully stated in the article, and the statement at top of third column, p. 442, should be corrected to read that from 14,600 ft. in to the point where the tunnel was "holed" there was little trouble from caving. Concerning the company's general officers, Mr. R. C. Chambers, the General Superintendent of the Ontario Mining Co., was the original discoverer of the Ontario lode in 1872 and has been the active manager of the mine ever since, having sole charge of the development of the property. Very truly yours, W. P. Hardesty.

Salt Lake City, Utah, Dec. 5, 1894.

DRIVEN VS. OPEN WELLS.

Sir: In your criticism of Mr. Creuzbaur's discussion of underground water supply in your issue of Nov. 22, 1894, you state that, "Driven wells differ in no wise from ordinary dug wells except in general dimensions and methods of operation." Do I understand you to imply that a system of driven wells, with a combined strainer area equal to the delivering area of a dug well in the same stratum of water-bearing sand, will deliver no more water than the dug well with an ordinary suction pipe drawing water therefrom as from a pond or lake? In other words, do you mean that the water would flow into driven wells under the influence of gravity alone as in the case of open-dug wells? Yours truly, J. L. Campbell.

El Paso, Tex., Dec. 3, 1894.

(What we meant to imply was that, so far as atmospheric effects were concerned, the two systems did not differ, as air freely permeates soil of the kind under discussion. In both the open well and the driven well, the quantity of water obtained will depend upon the pumpage power, the strainer area being assumed to be sufficient in the driven well plant. The supply to the well in both cases is the natural gravity flow in the subsoil; and the velocity of flow is dependent upon the nature or the friction in the water-bearing stratum and the hydraulic head. In the driven well plant the so-called "cone of influence" forms a reserve supply that may be consumed by heavy pumping; but in an open well, penetrating the saturated stratum to a like depth with the driven well, and assuming that this well can be pumped down to the bottom, you also have the same "cone of influence" and the same reserve as with the driven well. The advantage of the driven well over the open well is in its simplicity of application, and is not due to a difference in principle of action.—Ed.)

THE BEST METHOD OF ERASING LINES ON TRACING LINEN.

Sir: Mr. H. W. Brinkerhoff, in your issue of Nov. 15, disapproves of pumice powder applied to tracing cloth and recommends a smoother powder for rubbing off part of the gloss. We have, as a matter of fact, tried the substances he mentions and found them to be far inferior to pumice powder, which, I claim, is the only powder that will, if vigorously applied, deaden the surface of the glazed side of the tracing cloth sufficiently to allow of sharp, unbroken lines, so essential for photo-reproduction. In fact, the pumice powder so ef-

fectually removes the gloss, that pencil lines for alterations may be readily drawn on the glazed side.

In regard to erasures on tracing linen, Mr. Brinkerhoff claims that they are less noticeable if the dull side of the cloth is used. But if he will try pumice powder for making erasures on the glazed side of the cloth he will never use the dull side again, nor ever bother with knife or sand rubber to make erasures. Simply dip the tip of the finger into the powder and rub over the parts of the drawing which are to be erased, replacing the powder discolored by the rubbed-off ink by fresh at frequent intervals, until a perfectly clean surface is obtained. Of course the rubber might be substituted for the finger if the draftsman is averse to having his skin shaved down too closely. If properly done, erasures are made, by the aid of this powder, much faster than in any other way, and, above all, they are never noticeable as is the brownish tint left by rubber or knife-blade. The surface where these erasures are made is left practically intact, and the ink will not spread in drawing on those places again, a matter of great importance, as every draftsman knows. A single test will convince any one of the superiority of pumice powder for the last-named purpose at least. I may add that the pumice powder costs only 5 cts. per lb., while some of the smooth powders advocated by Mr. Brinkerhoff, are very expensive. This is a matter of trifling importance, however, compared with the other advantages of pumice powder for the purposes named.

Chas. W. Reinhardt,
Chief Draftsman, Engineering News.

THE STRENGTH OF CONCRETE AND STEEL FOUNDATIONS.

Sir: In your issue of Nov. 8 is printed a letter from Prof. W. H. Schuerman, containing a mathematical discussion of the bending moments upon the metal beams in concrete and steel foundations, in which reference was made to an article which appeared in Engineering News of Aug. 8, 1891, which described such foundations and gave, with an example, a mathematical formula for obtaining the bending moment. In commenting upon Mr. Schuerman's letter you refer to the discussion of the above-mentioned article, which appeared in subsequent numbers of Engineering News. The writer, having taken part in the discussion referred to, takes the liberty to correct certain statements, made with reference to that article, which do not correctly represent the facts. You stated that:

> In computing the strength of the foundation, the concrete filling around the beams was neglected, and the steel was given a unit stress considerably above the elastic limit, the concrete being relied upon to give sufficient additional strength to insure safety.

The actual facts are that, according to the article referred to, the I-beams and I-rail "seconds" in the foundation were given unit stresses of 20,000 lbs. and 16,000 lbs., respectively, both of which unit stresses were well within the elastic limit of the material. But the formula used to compute the bending moments upon which the design of the foundation was based gave bending moments which were in no case maximum, and which did not in any way indicate the amount of the maximum bending moment. It was to this fact that the criticisms made by the writer referred, rather than to the actual strength of the foundation; the criticisms were with reference to the formula for obtaining the bending moments and did not relate to the moments of resistance. It is true that the strength of the concrete filling was neglected, but the possibility of the additional strength of the concrete being required to resist a bending moment greater than the bending moments derived by the formula given, was not suggested in the article. Yet, if the load upon the foundation should become great enough to develop bending moments of sufficient magnitude to produce the assumed unit stresses (20,000 and 16,000 lbs.) in the beams at the points at which the formula gave the computed moments, then the bending moments, and consequently the unit stresses, in other portions of the foundation would be much greater, as was shown in the discussion at the time and is also shown in Mr. Schuerman's letter.

The question of whether the foundation did or did not possess sufficient strength, by reason of the additional resistance afforded by the concrete, was not entered into in that discussion; but it was quite conclusively shown that if it did possess sufficient strength, it was simply due to circumstances of the construction, and not to the calculations given in the article as a basis for proportioning the material.

That the concrete materially augments the strength of the foundation cannot be doubted, but that the combination of steel and concrete "really acts as a built-up beam, in which the concrete takes compression and the steel takes tension," is not by any means the case. The foundation cannot to any very great extent act as a built-up beam, if by a built-up beam is meant a beam built in the manner of a plate girder, in which the resistance of the flanges is by direct longitudinal stress. In a plate girder the resistance of the flanges and of the web are correlated; the connection between them must have sufficient strength at every point to transmit the increment of the flange stress, or, in other words, to resist the horizontal shear between the flange and web, which in a shallow beam becomes very intense. In the foundation in question, or in any similar foundation, the horizontal shear which must develop, if it acts as a built beam, will be found to very considerably exceed the resistance of the friction between the layers of steel, increased by the ultimate resistance of the concrete. The conditions necessary to develop resistance as a built beam cannot obtain to any great extent in these foundations, unless by some means the different layers of steel be efficiently connected.

Again, the construction of these foundations is not very similar to the Monier and Melan systems of concrete and steel construction, in which steel is introduced to aid the tensile resistance of the concrete. The strength of steel is very much greater than that of concrete; and while a reasonably small amount of steel introduced in the proper positions in concrete construction can add greatly to the strength of the structure, the addition of concrete to what is principally a steel structure cannot increase its strength to anything approaching the same extent. It must also be understood that the foundations are not so arranged that "the concrete takes compression and the steel takes tension."

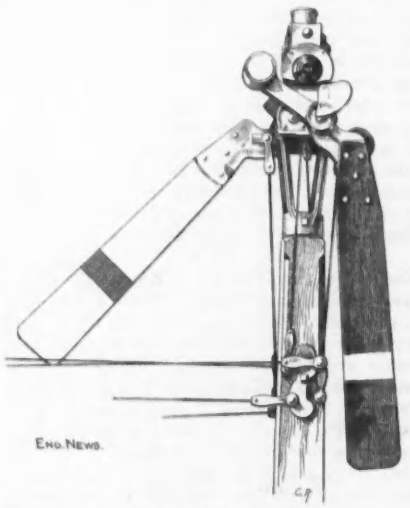
As to the proper method of computing the strength of these foundations, there is undoubtedly "plenty of room for honest difference of opinion;" but as to whether the foundation can develop an efficiency corresponding to that of a properly-constructed built beam, by reason of the connection between two parallel layers, effected by the intervening material, being sufficiently perfect to cause the layers to take direct longitudinal stress as flanges, the writer can discern no opportunity for any difference of well-considered opinion.

In conclusion, the writer would state that he does not wish to be understood as taking an attitude of antagonistic criticism toward this type of foundation; on the other hand, he believes it to be well adapted to certain conditions. But he does wish to be understood as stating very emphatically that in order to properly design any structure, it is necessary to ascertain the maximum effect of the external forces acting upon it.

Benj. F. La Rue.
Scranton, Pa., Nov. 16, 1894.

THE ECLIPSE THREE-POSITION SEMAPHORE.

A three-position semaphore is used on some railways as a block or train order signal, and one such device is shown in the accompanying cut, the right-hand blade indicating "track clear" or "no train orders" and the left-hand blade indicating "caution." The normal position of the blades is at "track blocked." The blades are of the usual form, but the counterbalance does not carry the lenses of the colored lights, as usual. Instead they are carried in separate frames working behind a protecting shield in front of the lamp. The blades are operated by wires and bell cranks in the usual way, the wires being connected to a small stand, with vertically moving levers, which is attached to the wall of the operator's room or tower. Between the two brackets which support the levers is placed an electric bell, the current for which is supplied by the local battery in the office, and the connecting wires, soldered to the battery wires, are so arranged that when the operating lever is moved from the normal or danger position the bell will ring and continue to ring until both levers are returned to that position. By this means the operator cannot fasten the train order signal at safety without having a constant warning that he is doing wrong ringing in his ear. The brackets are painted red, green and white, to show the proper position of the lever, and the latch which holds the lever at the white or green section does not hold the lever from returning to the normal "danger" position, but simply stops the lever at the proper place to indicate the desired signal, allowing it to go to "danger" in case of a wire breaking, etc. The levers, however, are latched at the "danger" position, so that it requires the latch to be released by hand. This signal is used on the Pennsylvania lines west of Pittsburg, the Baltimore & Ohio R. R. and other roads. It is manufactured under the Abernethy patents by the Eclipse Co., of Beaver Falls, Pa.



The Eclipse Three-Position Semaphore.

The company is also putting on the market a new signal pole of galvanized steel plate, octagonal in section, with the lamp sliding inside and raised by a wire or chain. It also manufactures a low switchstand, operated by a weighted lever; the weight, however, does not drop below the stand and is, therefore, clear of mud or slush. In switch signals the signals are connected directly with the points of the switch rails, so that the signal cannot show safety unless the switch is properly set.

CAR LIGHTING BY STORAGE BATTERIES ON THE CHESAPEAKE & OHIO RY.

The many advantages of electric lighting for railway cars, in point of brilliancy of light, cleanliness, and freedom from heat and odor, and last, but by no means least, popularity with the public, have made it a favorite subject of invention and experiment ever since the invention of the incandescent lamp. The system most used in this country has been the combined dynamo and storage-battery system. This was adopted experimentally on the Chesapeake & Ohio Ry. in 1890 for the cars of its limited express trains between New York and Cincinnati. An engine and dynamo were placed in the baggage car, steam being supplied from the locomotive, and storage batteries were provided to furnish current in the event of failure of the dynamo, which failures are said to have been so frequent as to make the system unsatisfactory. For the year ending June 31, 1891, the running expenses under this system were 30 cts. per lamp per day, 2½ cts. per lamp per hour for 12 hours' actual service, or 0.156 cts. per candle-power per hour.

About three years ago it was decided to try the Silvey storage-battery system. Two cars only were at first equipped, but these gave such satisfaction that six months later 23 cars were in service, and later additions have brought the number of cars equipped up to 70 in November last.

The classes of cars and total number of lamps are as follows:

		Lamps per car.	Total lamps.
8	Pullman sleeping cars	27	216
10	express cars	3	30
4	mail cars	10	40
12	combination cars	9	108
28	first-class coaches	10	280
2	observation parlor cars	17	34
6	dining cars	21	126
70	cars; total lamps		834

After improving the storage battery service in the cars running to Washington, it was decided that electric lighting could be extended to the cars running through to New York, the cars for this latter service being provided with one more set of batteries (12 cells) than the Washington cars. This change was carried out in April, 1894, at which time all the dynamos and engines were removed from the trains after being in service for seven or eight years. The batteries have ample capacity, although the sleeping, dining and day cars have frequently been

cut out of trains and held in New York much longer than their regular time, and in a few cases sleeping cars have made two round trips and have returned to the charging station at Covington, Ky., with good lights. It is said that, comparing the storage battery system with oil and Pintsch gas lights, all of which are in use on this road, the former shows fewer failures of light than either of the latter for the number of cars operated. In fact the system has been so satisfactory, that Mr. W. S. Greene, electrician for the railway company, has been instructed to prepare estimates for an auxiliary charging plant at Richmond, Va., to supply through cars, which run over the Eastern Division and do not go to Covington. The storage battery plant now in service has a total capacity of 649,000 ampere-hours, or 1,229,000 watt-hours. The cost of gas and electric lighting for the six months ending June 30, 1894, shows the following comparison, interest and depreciation being included in the first two columns, but not in the third:

	Silvey stor. batt.	Pintsch gas	Dyn. & batt., 1891.
Cost per car per month	$13.23	$17.60	...
Cost per lamp per hour	.02 2-5	.03	$0.02½

The cars are fitted with 24-volt. 2½-watt lamps, so that 12 cells of battery are required to operate them at their full rated candle-power. The batteries are made in sets of 12 cells, so that one set may be used for cars having a few lamps, while three sets are used for the sleeping cars, which have 27 lamps each. At the charging station, at Covington, Ky., there are charging racks sufficient for 96 cars in 24 hours, but so far it has not been necessary to run it more than 12 hours daily, each battery being rated by the manufacturers at 350 ampere-hour capacity, and charged at a rate of 35 to 40 amperes, so that a 10 or 12-hours' charging is ample. The charging plant consists of two locomotive type boilers, a 75-HP. engine, two Silvey dynamos of 600 amperes capacity at 40 volts potential, and two Eickmeyer dynamos of 80 amperes at 80 volts, and a condenser to supply the condensed water used in the batteries.

The battery cells are arranged in trays, six being placed in each tray, two trays constituting a complete set, or 12 cells of battery, coupled in series, giving a working output capable of operating 24-volt lamps in the cars up to their full candle-power. The station is provided with a charging table, each division of which has rollers, so that the operator can slide the battery trays into position with very little effort.

Between the racks are small tramways, in which a transfer truck travels, so that, in supplying the trains with batteries, the trays are pulled from the charging racks onto the transfer truck, and carried thence to the train and put into the car boxes. Each end of the truck is provided with a vertical screw, so that by turning the hand wheel the frames may be raised or lowered to conform to the irregular heights of passenger cars. The car boxes, as well as the battery trucks, are provided with 3-in. rollers, on which the battery trays rest. It is found to be perfectly practicable for two men to change all the batteries under an entire train in less than 15 minutes.

For operating the light in the cars a switch of the snap variety is provided, having a cover and a key of peculiar pattern for turning the light on or off, thereby preventing any meddling with the circuit. Each lamp is also provided with a key socket and a fusible cut-out, making it impossible for any lamp to disarrange the operation of the others, and by the patented equalizing system of wiring employed with the Silvey system every lamp burns alike. By placing the lamps beneath the deck sill of the car and by staggering them, every part of the car is lighted uniformly. The lighting of each car is independent. It has been found in practice that the batteries will light the cars for three nights at one charging, and are, therefore, able to light a train for a journey of about 2,000 miles.

In the construction of the batteries, which are made by the Silvey Storage Battery Co., of Dayton, O., strength and durability are preferred rather than light weight and high efficiency. In fact, it is said that cells have been frequently discharged at the factory at a rate of four to five times the rated capacity without buckling the plates or making them lose their active oxides.

The battery plate proper consists of an inoxidizable alloyed lead grating 6×12 ins. and about ⅛ in. thick, 21 plates constituting a complete battery cell. The perforations in the grating are filled with superficially oxidized particles of metallic lead and oxide of lead, after which they are subjected to a pickling process which hardens the fine particles into a hard, coherent mass, and by which it becomes firmly fixed in the holes, and forms a surface layer over the entire plate. The plates are then assembled in proper number to constitute a complete battery, there being 11 negative and 10 positive battery plates. The plates are clamped together by means of a lead screw passing through a hole in the plate, nuts being placed between the plates and firmly screwed down, whereby good metallic contact is made, after which they are all electrically welded on the surface and all soldering is avoided. In case it ever becomes desirable to take the cell apart, it is easily done by removing these nuts, which by turning break the welded parts. The filling for the battery plates is chemically pure lead, and has been found in practice to give a useful working output of about 20% greater efficiency than batteries employing a mechanically-filled plate of lead oxide alone.

Between the sets of plates is placed a sheet of a porous separating material, the edges of which are saturated with a preservative compound and which has been treated with acids and alkalies until it becomes practically indestructible, and this is capable of absorbing about 50 times its own weight of the acids used in the battery. The latter in fact becomes nearly a dry cell, or, in other words, there is very little free liquid to become spilled. Should the rubber cell ever become broken, the liquid held in suspension in this absorbent separating material is sufficient to operate the car properly during a trip. In order to prevent a possible splash of the free liquid on top of the battery plates, the rubber cell is made very deep, the plates only filling the jar to about half its depth; and, as an additional precaution, a sort of wooden crate is placed on the top of the plates, dividing the interior of the cell into small pockets, and thus preventing the formation of waves during rapid motion of the car.

We are indebted to Mr. W. S. Morris, Superintendent of Motive Power of the Chesapeake & Ohio Ry., for the following statement of the cost of this system of lighting on 41 cars in passenger service, for the month of July, 1894:

Cost of Car Lighting by Electric Batteries; Chesapeake & Ohio Ry.

Cost of Charging Plant:			
Building			$1,880.00
Two dynamos and fixtures			3,401.80
Engine, 75-HP.			806.00
Boiler and setting			550.00
Station wiring			58.00
Extra armature			309.50
Transfer truck			63.00
Total			$7,078.30
Cost of Car Equipment:			
7 express cars	$30.40	each	$212.80
4 postal cars	69.50	"	278.00
8 combination cars	37.60	"	300.80
10 coaches	57.60	"	576.00
6 dining cars	71.30	"	427.80
4 sleeping cars	250.00	"	1,000.00
2 parlor cars	58.20	"	116.40
41 Total			$2,911.80
Cost of Batteries:			
86 sets of 12 cells each, $180 per set			$15,480.00
Total cost of entire plant			$25,470.10
Expenses for One Month, July:			
Depreciation of charging plant, at 6% per annum			$35.39
Interest on charging plant, at 6% per annum			35.39
Depreciation of car equipment " "			14.56
Interest on " " " "			14.56
Interest on batteries " "			77.40
Maintenance and renewals, labor			366.25
" " material (incl. fuel)			1,782.82
Total			$2,326.37
Total No. of lamps in 41 cars			501 lamps
" " " per car			12 "
Actual time all cars are lighted during the month			8,742 hours
Actual time all cars are lighted per day			282 "
" " each car is lighted per day			7 "
Cost of Lighting During the Month with Twelve 16-c p. Lights, Giving Light of 192 c. p.			
Cost per car per month			$56.74
Cost of car per day, 7 hours' lighting			1.83
Cost per car per hour			.26
Cost per lamp per hour			.02 1-6

RECENT TESTS OF SMOKELESS POWDERS.

A report, soon to be presented by General Flagler, Chief of Ordnance, U. S. A., says the Washington correspondent of the New York "Sun," will give the following facts relating to recent tests of smokeless powders:

Some creditable results have been obtained with Leonard smokeless powder in a 5-in. Brown segmental wire gun. To a 60½-lb. projectile a charge of 25 lbs. gave 2,663 ft. per second of muzzle velocity, with 34,707 lbs. of pressure per sq. in.; a charge of 30 lbs. gave 3,128 ft., with 53,700 lbs. pressure, and a charge of 32 lbs. gave 3,110 ft., with 52,934 lbs. pressure. With a 45-lb. projectile a charge of 30 lbs. gave 3,024 ft. of muzzle velocity, with 40,170 lbs. of pressure. Other results were obtained, and, though a little irregular, all showed high ballistic qualities. In a 3.2-in. Driggs-Schroeder rifle, with a 13½-lb. projectile, 1½ lbs. of powder gave 1,850 ft. of muzzle velocity, with 18,250 lbs. of pressure, and a 2-lb. charge gave 1,937 ft., with 24,400 lbs. pressure. In a Driggs-Schroeder 6-pdr. a charge of 1 lb. gave 2,019 ft., and a charge of 1¼ lbs. gave 2,243 ft.

In the 8-in. rifle 45 lbs. of German smokeless powder imparted 1,865 ft. of muzzle velocity to a 300-lb. projectile, with 30,945 lbs. pressure, while a charge of 46 lbs. and a 302½-lb. projectile gave 2,018 ft., with 31,770 lbs. pressure. This powder had been kept nearly three years hermetically sealed, and the result showed that it had not materially deteriorated from the long storage.

In due time it may be hoped to have results made public from the trial of Walsrode smokeless powder for field guns and of Cologne-Rottweil for 8-in. and 12-in. rifles. But a specially interesting step was taken some time ago toward competitive tests of smokeless powders for field, siege, and seacoast guns at Sandy Hook.

Such powders were called for by the ordnance authorities. The specifications for the 3.2-in. gun required an initial velocity of 1,450 ft. with a 16½-lb. projectile, and a pressure not exceeding 30,000 lbs. For the 5-in. siege gun the velocity was fixed at about 1,830 ft., and the maximum pressure at 31,300 lbs.; for the 7-in. howitzer, at 1,085 ft., and the pressure at 26,880 lbs.; for the 8-in. rifle, 2,000 ft., with 36,300 lbs.; for the 10-in. rifle, 2,025 ft. and 33,000 lbs. While for the two latter the highest velocities within allowable limits of pressure and erosion are sought, in the siege gun and howitzer only the standard for black powder is fixed. Bids for these powders were received from the Maxim Co., Du Pont de Nemours & Co., the Leonard Co., and the California Works, which manufacture the Peyton powder. From lack of funds, awards were given only for the 8-in. gun, with ten charges for that caliber.

The cartridges for the new army magazine rifle of .30 caliber are made now with Peyton powder, although an order has also been placed for Leonard powder. The required muzzle velocity is 2,000 ft. per second, with a mean variation of 1% in 20 consecutive rounds, and a maximum pressure of 38,000 lbs. per sq. in. Tests for unusual heat, cold, moisture, corrosive effect, heating of the barrel, and so on, are applied. To determine the heating of the barrel, a thermometer is lowered into the bore, the breach closed, and the muzzle corked. After firing 25 rounds of Peyton powder in 64½ seconds, the temperature had risen from 89° to 196°. In testing the temperature of ignition of Peyton powder, the substance boiled at from 285° to 289°, but did not explode. It exploded, however, at 293° after 58 seconds; at 338° after 24 seconds, and at 392° after 14 seconds. The grains boiled up a few seconds before exploding.

General Flagler also notes the tests for sun exposure with Peyton and Leonard powders, which contain nitro-glycerine, and with the foreign Troisdorf, Wetteren, Walsrode, and Rifleite, all gun-cotton powders. They were placed in shallow glass-bottom trays for eight weeks during the winter and covered with glass. The nitro-glycerine powders showed the most loss of weight, the most change in color and grain, and the greatest exudation, although in velocity, stability, and temperature of ignition the changes of the best samples of them compared favorably with those of the gun-cotton powders. The latter also showed more corrosive effect on steel plates when burned in the air, especially when the flashed residue remained for some time undisturbed.

But thus far it has not been found of advantage to substitute smokeless for black powder in the old .45-caliber Springfield rifle, where this is retained in use. Promising results are obtained with samples of .30-caliber smokeless powder made by the Giant Powder Co., of California, although it has not yet been made in quantity or, it would appear, fully tested for stability or keeping qualities. Four rounds of one sample, 45 grains each, at Benicia, gave 2,145 ft. mean velocity, and a variation of only 5½ ft., with-

39,250 lbs. pressure. Two rounds of another sample, 43 grains, gave a mean velocity of 2,120 ft., no variation whatever, and 35,750 lbs. pressure. A third sample of 37 grains gave for three rounds 2,084 ft. per second, with 36 ft. variation, and 41,500 lbs. pressure. Other small-bore smokeless powders from which more may be heard hereafter are those presented by Albert Smith and H. P. Weldig, the latter said to be pure cellulose treated in a peculiar way, and also a powder sent by Mr. Heidemann, director of the Cologne-Rottweil works. This last is said to contain no glycerine, and to have as a characteristic very little action on the bore, the accuracy of fire from a German rifle not being materially altered after 10,000 rounds.

PROPOSED STANDARD ANGLE-BAR SECTION; CARNEGIE STEEL CO.

At the time when a committee of the American Society of Civil Engineers was considering the subject of rail sections, it was thought by some engineers that the investigations might well have included the sections of spliced bars, and that a standard angle-bar section ought to be designed for use with the standard rail sections. Some time ago this matter was taken up by the Carnegie Steel Co., and the results of its work in this direction are explained in the following letter:

Sir: It is a gratifying fact to note that although less than two years have elapsed since the Rail Committee of the American Society of Civil Engineers reported and recommended their "Standard Rail Section," many of our leading railroads throughout the country have adopted the same. It will also no doubt interest you to know that the general design has so commended itself to us as manufacturers that for all light section rails, 50 lbs. and less in weight, we have adopted the committee's suggestions, and are now manufacturing our small rails, viz., 16, 20, 25, 30, 35, 40, 45 and 50 lbs., exclusively on the basis and design recommended by the Society.

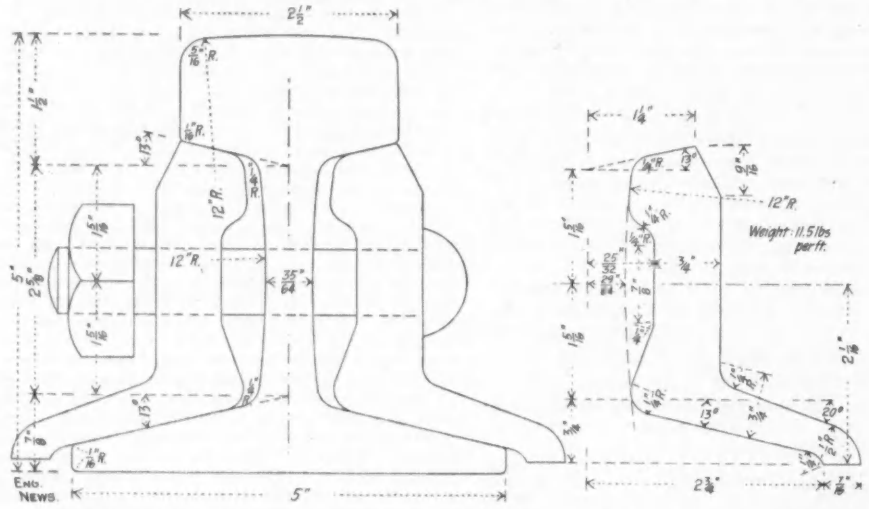
The subject of "standards" is such an important and vital one to large corporations, especially railways, that any proper steps in this direction are practically unassailable, as the accruing benefits are self-evident. It is to be regretted that sufficient time was not allotted to the former Rail Committee to follow up their admirable rail sections with a standard angle splice bar. Expressions of regret have reached us from many quarters, indicating the necessity of such a bar as supplemental to the American Society of Civil Engineers' standard rail.

The subject has, therefore, received considerable thought and study at our hands, and in connection with several members of the former Rail Committee, an angle splice bar has been designed which contains certain features commendable to the practical engineer. A set of prints, showing the design of this angle splice bar, as applicable to standard rails 35 to 100 lbs. inclusive, is mailed you under separate cover.

Already this bar has been approved and adopted by several of the leading railways, and we understand is giving entire satisfaction. The parallel sides of the web, coupled with the fact of having sufficient metal in both the head and base to overcome the liability of "bulging" from punching, is one of the principal features from an engineering and practical standpoint.

From a commercial view, this bar also presents advantages which should not be lost sight of. Its adoption as a standard will naturally permit of its manufacture in large quantities, and at reduced cost, thus enabling sales to be made at less price than for any particular individual design.

We would esteem it a favor to have your views on this subject, and would like an expression of opinion on the design of splice bar submitted. It is altogether probable this question will come before the next annual meeting of the American Society of Civil Engineers, in January, 1895, and your co-operation towards establishing a "standard angle splice bar" is respectfully solicited. Yours truly, John G. A. Leishman,
Vice-Chairman Carnegie Steel Co.



PROPOSED STANDARD ANGLE-BAR SECTION: CARNEGIE STEEL CO.

We show in the accompanying cut the standard splice for the 80-lb. rail. The splices for rails of other weights have a section practically the same in form. The weights of the bars of the various sections are given in the following table:

Wt. of rail per yd., lbs.	Wt. of bar per ft., lbs.	Wt. of rail per yd., lbs.	Wt. of bar per ft., lbs.
35	4.3	70	10.0
40	5.0	75	10.7
45	5.8	80	11.5
50	6.6	85	12.4
55	7.5	90	13.5
60	8.5	95	14.7
65	9.2	100	15.8

The reinforcement of the upper and lower parts of the bar, so as to increase the bearing area and also increase the stiffness of the splice, is in line with the opinions several times expressed by us, but it is probable that the narrow lower flange will be objected to by many engineers, especially those who favor driving the spikes through holes, instead of notches in the flanges of the angle bars. Some of the principal roads, however, use very narrow flanges, and for the convenience of those who wish to compare the angle-bar sections now in use by different railways, we append a list of references to angle-bar standards, recently shown in these columns:

Wide-flanged bars—Boston & Albany, R. R., April 4, 1891; Fall Brook R. R., March 5, 1892; Quebec Central R. R., March 19, 1892; Canadian Pacific Ry. and Grand Trunk Ry., Jan. 19, 1893. Short-flanged bars—Baltimore & Ohio R. R., July 18, 1891; New York Central R. R., April 2, 1892; Pennsylvania R. R., July 21, 1892; Chicago & Northwestern Ry., Sept. 7, 1893.

COMPARATIVE MERITS OF VITRIFIED PIPE AND BRICK FOR LARGE SEWERS.

The use of large size vitrified pipe, as a substitute for brick in the construction of sewers has been extending rapidly of late years, and to meet an evident demand manufacturers have been improving the quality and increasing the dimensions of pipe for this purpose, and at the same time reducing the cost. The use of vitrified pipe has been carefully investigated by the London Board of Health, among other authorities, and that body unhesitatingly declares in favor of it, as compared with brick sewers of similar diameter. The Board says that brick sewers are wasteful in construction and repairs, costly through inefficient efforts to keep them clean, and wasteful of the water supply in attempts to flush them. Pipe sewers, on the other hand, have smooth interiors permitting the maximum gradient and capacity of discharge, and can be more rapidly and cheaply laid, as cheap labor can be used, and can be made very tight. The vitrified material, properly proportioned in thickness to the work to be performed, is also practically indestructible. These views few engineers will dispute, and the question practically settles down to one of comparative cost of the two materials. But in estimating this cost, lasting qualities and efficiency in conveying sewage to an outlet must be considered as well as the first expense of buying the material and laying the sewer.

We recently learned that the Blackmer & Post Pipe Co., of St. Louis, Mo., had sent out a large number of inquiries asking the opinions of city engineers upon the comparative merits of the two kinds of sewers, and we inquired as to the results of the investigation. In reply the firm sent us the original letters received from a large number of city engineers, and in looking them over we note many points of interest.

In its circular letter the firm named asked the opinions of the parties addressed upon the comparative durability, ease of laying, indestructible character, capacity of discharge and first cost of the 30-in. vitrified pipe and the 30-in. brick sewer. They quoted the 30-in. vitrified pipe at $1.35 per lin. ft., f. o. b. at the company's works, and gave the following average estimate of the cost of this pipe laid, but omitting cost of excavation and backfilling, as being the same for both kinds of sewers. Cost of pipe on cars at railway station, say, $1.65 per lin. ft.; unloading and hauling to ditch, 5 cts. per ft.; laying pipe, 10 cts. per ft.; total laid, $1.80 per lin. ft.

Replies came, among others, from the city engineers of Lawrence, Mass.; Hot Springs, Ark.; Adrian, Lansing and Manistee, Mich.; Brainerd, Minn.; Cumberland, Md.; Salina, Kan.; Lafayette, Ind.; Manchester, N. H.; Warsaw and Little Falls, N. Y.; Salt Lake City, Utah; Memphis, Tenn.; Harrisburg, Titusville and Altoona, Pa.

In no case among the various letters sent do we find any doubt expressed as to the superior merit of the vitrified pipe for the purpose intended. Comparative cost was the chief point at issue. On this head, and on the same basis of omitting cost of excavating and back-filling, the engineer of the Hot Springs Reservation wrote that the 30-in. brick sewer there cost $2.07 per lin. ft. At Lawrence, Mass., the cost of a two-ring brick sewer was placed at $2.50 per ft.; in Salt Lake City, a 30-in., two-ring brick sewer, plastered on the inside with ½ in. of cement, costs $3 per ft.; and from Titusville, Pa., the estimate was $2.65 per ft. Mr. Niles Merriweather, City Engineer of Memphis, wrote that they have lately been building culverts of 48-in. cast iron pipe, bought at a little less than $18 per ton. But for a 30-in. sewer he would certainly prefer the vitrified pipe to brick.

One engineer particularly points out that, while the excavation and back-filling are left out in these comparative estimates, on the assumption that they are the same for each class of sewer, the brick sewer really requires about double the amount of excavation necessary for a pipe sewer of the same inside diameter, on account of the room needed for the bricklayers. Several writers object that the cost of the necessary Y-connections would add considerably to the total cost of a sewer. To this objection the manufacturers reply that, at the present price of these 30-in. Y-branches, if placed at 25-ft. intervals, the cost of the whole sewer would be increased by an amount equal to 3 cts. per lin. ft. over the cost of plain straight pipe.

THE DANGER OF TAPPING WATER-BEARING SAND UNDER PRESSURE.*

The town of Schneidenmuehl, in which the well referred to is situated, lies in the Province of Posen, near the West Prussian boundary. In the autumn of 1892 the sinking of the well was commenced, and in May of the next year had reached a depth of 238 ft. From 49 to 52 ft. of the upper layers were comparatively firm; then a layer of sandy silt was struck, having a thickness of 180 ft. A current of water was used during the boring operations as long as the up-

*From "Abstracts of Papers," Institution of Civil Engineers.

ward pressure of the ground-water permitted. The tubes had a diameter of 4.72 ins. to a depth of 82 ft., when they were reduced to 3.15 ins.

On reaching a depth of 210 ft. a strong current of muddy water issued from the tube. Sinking was continued, when at a depth of 236 ft. the flow from the tube ceased; but a strong jet of water, amounting to 220 gallons per minute and containing 5 to 6% of solid matters in suspension, issued through the ground at the side of the tube. The cause of the hydrostatic pressure which ejected the water with such force is sought for in the geological formation underlying the town of Schneidenmuehl. This town lies in the valley of the River Kuedow, an affluent of the Netze, and is partially surrounded by hills composed of drift-sand, which offer little obstacle to the percolation of any rain-water falling upon them. Upon this sand, however, lies an impervious deposit composed of the more or less clayey sendiment left by the river, and this deposit appears to have resisted the pressure of the water until it was pierced during the sinking of the well.

An endeavor was made to stop the flow of water by drawing the tubes, but this proved unsuccessful because all solid matter which fell into the well from its sides was at once ejected with the water. Owing to the quantity of sand thrown out, considerable subsidences of the surface took place, and the adjoining buildings were seriously damaged. Bags of sand and clay, stones, etc., were thrown into the well; but these were all swallowed up without staying the flow of water. An attempt was then made to dredge out a well or shaft round the tube, but, after eight days' hard work, a depth of only 2 ft. was reached, owing to the quantity of sand driven up from below. It was next decided to drive down several tubes to the depth from which the water came, and this was done; but several of the tubes sank and were lost, so that finally only one tube remained, the minimum diameter of which was 5.9 ins. On the 15th of June the ground sank suddenly to the extent of 4.26 ft., carrying with it part of the adjoining houses. After this the flow of water became less, and none reached the surface except through the tube. On the 21st of June tubes of gradually diminishing diameter were fixed upon the main tube, when it was found that the water rose to a height of 65.6 ft. above the street level. By means of taps at different levels the water was gradually cut off, and on the 22d of June it had altogether ceased to flow, and the danger to the town appeared to have been averted.

On the 20th of September, however, the plug which closed the tube was removed, and the water again began to flow, sometimes containing as much as 20% fine sand. The water forced its way upwards outside the tube, and finally the tube and the whole superstructure of the well sank. The method devised to close the well was to heap as rapidly as possible sufficient earth or sand upon the spot, so that the weight of the layer would counterbalance the upward thrust of the water. An area 69 ft. in diameter was cleared, and the six tubes were carefully filled with fine sand. The earth and sand which had previously been brought to the spot were thrown in at the rate of 1.362 cu. yd. per minute until a conical mound was formed 9.56 ft. high and 69 ft. in diameter at its base. This method proved successful, and the issue of water from the bore hole has now ceased.

GOVERNMENT DRY DOCKS OF THE UNITED STATES.

In a paper dealing with the experience gained with the new steel ships of the Navy, presented at the recent meeting of the Society of Naval Architects and Marine Engineers, Mr. Philip Hichborn, Chief Naval Constructor, stated that nothing has been more clearly brought out by experience with these vessels than the fact that ample docking facilities are absolutely necessary if the ships are to be kept in efficient condition. The docks we now possess at the navy yards and stations are barely adequate to the peace needs of our present navy, and in time of war we should be very seriously embarrassed. The accompanying table gives the dimensions of the government docks. Into the present completed docks our four most powerful battleships, the "Indiana," "Massachusetts," "Oregon" and "Iowa," cannot enter without being lightened considerably. Fortunately the Port Royal dock, which is larger, is very near completion and should soon be ready for service. No private dock in the United States will take them, and, in fact, the Halifax graving dock will be the only dock in either North or South America, except the three government docks under construction, which will accommodate our largest vessels.

Dimensions of U. S. Government Dry Docks.

Location of dock.	Extreme length. ft.	Length, bottom. ft.	Breadth, entrance. ft.	Ht. of sill abv. bot. of dock. ft.	Dpth sill w.at ord. at h.w., spg. tides. ft.	Diff. bet. h. w. at ord. and neap tides. ft.	Remarks.
Boston, Mass.	396.5	367.5	60.0	2.0	25.0	3.5	Granite dock.
Brooklyn, N. Y.	369.3	333.3	66.0	2.0	25.0	0.5	" "
" " "	500.0	459.8	85.0	2.2	25.5	0.5	Simpson dock.
" " "	670.0	626.7	105.2	2.4	28.0	0.5	Under construction. Wood.
League Island, Pa.	500.0	459.8	85.0	2.2	25.5	..	Simpson dock.
Norfolk, Va.	331.8	302.8	60.0	2.0	25.0	..	Granite dock.
" "	500.0	459.8	85.0	2.2	25.5	..	Simpson dock.
Port Royal, S. C.	496.0	459.0	97.0	2.0	26.0	2.5	Under construction. Wood.
Port Orchard, Wash.	650.0	618.5	92.7	2.3	30.0	..	" " "
Mare Island, Cal.	513.0	459.0	79.0	4.5	27.5	1.0	Granite dock.

Agitation for the removal of grade-crossings has begun in Newark, N. J. There are said to be 500 passenger and 117 freight trains passing through the city daily, and crossing accidents are frequent. The Pennsylvania R. R. is said to be favorably disposed to the improvement.

Plans and estimates for a double-track cantilever bridge to replace the Grand Trunk suspension bridge over the gorge below Niagara Falls are being prepared by Mr. L. L. Buck, M. Am. Soc. C. E. The present bridge is inadequate for the traffic and if the cost is not too great, it is proposed to replace it with a cantilever.

A tunnel, 2.5 m., or 8.2 ft., in diameter, has recently been driven under the Seine, at Clichy, Paris, by Mr. J. Berlier, upon the method known by his name. The tunnel is 1,518.6 ft. long, and is 49.2 ft. below the surface of the river. The tunnel itself is made of cast iron segments, coated inside and out with cement, and it was driven by means of a shield 4 ft. long, provided with a cutting edge and pushed forward by five hydraulic jacks. The tunnel was built in narrow rings bolted together after the shield had advanced about 20 ins. The small space left outside the rings was filled with cement, injected through holes left in the segments and under a pressure of from 3 to 4 atmospheres. A progress of 8 ft. in 24 hours was sometimes made. This tunnel was driven on a grade of 7 mm. per meter, and after describing a curve of 100 m. radius rose upward to the left bank of the river with a grade of 80 mm. per meter. The material penetrated was mud, running sand, flints and conglomerates, some of which was blown up by dynamite. Much water had to be dealt with and compressed air was used. The purpose of the tunnel is to take the sewage, now discharging into the Seine at Clichy, across that river and to the new sewage farm at Acheres, authorized by the French government in April, 1889. Mr. Berlier drove the tunnel at his own risk, and was successful. At the late official inauguration of the tunnel he was made a Chevalier of the Legion of Honor; Assistant Engineer Alain-Amiot was decorated with "palms" of the Academy, and medals were distributed among the workmen.

The Naval Hydrographic Office, at Washington, reports that the Morgan Line steamer "El Sol" was recently struck by lightning on her way to New York. The effect of the stroke on the pilot house compass was to reverse the needle—the north end pointing south. The bridge compass, 10 ft. further aft, showed a change of from 4 to 8 points, and the other compasses showed very considerable change. On reaching New York the compasses were all readjusted, but there was considerable deviation again on the return voyage, showing that the effect of the lightning stroke was not permanent.

Aluminum is better adapted than magnesium, cadmium or zinc for marking upon glass. M. Charles Margot, who has been investigating this feature of these metals, says that the trace is formed by strongly adherent metallic particles, and in the case of aluminum the design is made more apparent by breathing upon the glass, and thus forming a condensed vapor. The glass should be perfectly clean, and when this is the case, the traced lines cannot be removed by washing. This property of aluminum seems to depend upon the composition of the surface to be marked. A plainly apparent mark is obtained on all silicates; but aluminum will not mark simple bodies, and especially not the diamond. M. Margot suggests the aluminum point as a simple means of distinguishing between the diamond and all manufactured or natural silicates.

An electric railway, 4,000 miles long and touching every county seat in Ohio, is apparently seriously proposed by Mr. Martin Dodge, of the Ohio State Legislature. He bases his proposition upon the late report of the Ohio State Road Commission favoring the construction of electric lines. Mr. Dodge estimates the cost of his project at $20,000,000, half to be paid by the State and half by the several counties, based on the number of miles within the county limits. He says nothing as to the management of this colossal public work, nor who is to pay its operating expenses.

CONSTRUCTION NEWS.

RAILWAYS.

East of Chicago—Existing Roads.

BALTIMORE & OHIO.—G. B. Hazlehurst, Supt. Motive Power, Baltimore, Md., is preparing plans for a large freight yard and extensive shops at Cumberland, Md., but we are informed that the only work contemplated at present is a freight yard reported as to have track room for 3,000 cars and a 44-stall roundhouse, with small machine and blacksmith shops attached.

BENTON HARBOR & SOUTHEASTERN.—A correspondent writes us that the capital for the construction of this railway has been secured and that the construction is now in progress in Michigan. The line extends from Benton Harbor, Mich., to South Bend, Ind., and thence through Nappanee and Huntington to Dayton and Cincinnati. W. W. Graves is chief engineer in charge of the work. The road is expected to be finished next summer. J. M. Caulfield, South Bend, Ind., is interested.

BOSTON & MAINE.—It is stated that the New Hampshire legislature will be asked for a charter for an extension of the Manchester & Keene road from Greenued to Manchester.

CANADIAN SUBSIDIES.—Press reports state that the following is the list of the railways subsidized this year by the Provincial legislature: Quebec & Lake St. Joan, $589,258; Baie des Chaleurs, $168,180; Montreal & Western, $80,000; Ottawa & Gatineau Valley, $72,800; Canada-Atlantic, $4,000; Montford Colonization, $54,250; Oxford Mountain, $215; Lothiniere & Megantic, $51,983; United Counties, $57,042; Phillipsburg Quarrier Junction, $25,120; Quebec, Montreal, Ottawa & Occidental, $46,977.

ULSTER & DELAWARE.—At the annual meeting of the stockholders at Kingston, N. Y., Dec. 4 a committee was appointed to report a plan for an extension from Ronkout to Kingston Point, to give the road direct connection with the Albany day line steamers.

Projects and Surveys.

AMSTERDAM, JOHNSTOWN & GLOVERSVILLE.—A correspondent writes us that this will be a steam railway extending from Akin, a small town 2½ miles west of Amsterdam, N. Y., to Johnstown and Gloversville, 14 miles. The final survey has been completed and part of the right of way secured. The necessary capital for the construction has been obtained and the contract for building the road will be awarded early next spring. Pres., David A. Wells, Johnstown, N. Y.; Ch. Engr., Samuel Moak, Amsterdam, N. Y.

CENTRAL MICHIGAN.—Press reports state that Jerry Boynton, Grand Rapids, Mich., the promoter of this railway, is securing considerable aid along the route of the proposed road, which is projected from Grand Haven, Mich., by way of Grand Rapids, Gun Lake, Battle Creek and Coldwater to Lima, O. Mr. Boynton was president of the Grand River Ry. Co., which partially built a road from Grand Haven to Grand Rapids a few years ago. It is stated that the new road will be built under the name of the Grand River R. R. & Transportation Co.

HAMILTON RADIAL.—The network of electric steam railways proposed by this company was noted in our issue of Nov. 29. Press reports state that the contract for building the main line from Niagara Falls to Shaw Station, on the main line of the Canadian Pacific, has been awarded to Bracey Bros., Chicago, who are building the Toronto, Hamilton & Buffalo. The contract calls for the completion of the line from Hamilton, Ont., to Grimsby, 15 miles, by Jan. 15, and to St. Catharines by Feb. 15, 1895. Over 500 men will be put to work immediately. In the meanwhile the Niagara Central & St. Catharines, between St. Catharines and Niagara Falls, will be placed in first-class condition. The Radial company has decided to build to Shaw Station instead of Guelph Junction, as at first proposed. The company has also modified its request of the city of Hamilton for a bonus of $400,000 to one of $300,000. The Canadian Pacific is said to be back of the scheme.

PITTSBURG, BRADY'S BEND & LAKE ERIE.—Incorporated in Pennsylvania, Dec. 18, to build a railway from Brady's Bend to Butler, 20 miles; capital stock, $600,000; Pres., Joseph Pool, New York; directors, Isaac Hough, David B. Erwin, Albert E. Peterson, Richard H. Boy, Philadelphia; Fred W. Scheffmeyer and Haywood R. Pool, New York.

Southern—Existing Roads.

CHARLESTON, CLENDENIN & SUTTON.—This company has issued $3,000,000 in bonds to extend the line from its present terminus to Sutton, W. Va., and it is reported that bids for the construction are now being received by John H. Drake, Charleston, W. Va. ——Clay county, W. Va., recently voted to subscribe $25,000 to the capital stock of this company.

ELLAVILLE, WESTLAKE & JENNINGS.—This railway has been opened for traffic from Ellaville to Westlake, Fla., a distance of 11 miles. Gen. Man., E. E. West, Ellaville, Fla.

LOUISVILLE & NASHVILLE.—A press report states that the Gulf Transit Co., of Pensacola, Fla., is being organized by M. H. Smith, Pres. L. & N., H. W. Bruce and W. H. Reynolds, of Louisville, Ky., to increase the export and import business of this company.

MACON, DUBLIN & SAVANNAH.—D. B. Dunn, Ch. Engr., Macon, Ga., writes us that a line has been run for the proposed extension from Dublin, Ga., to Savannah, 113 miles, and the estimates for construction submitted to the management. Pres., G. B. Shaw, Chicago.

MOSS POINT & PASCAGOULA.—G. H. Houze, Pres., Moss Point, Miss., writes us that this railway will be completed ready for operation by Dec. 20 between Moss Point and Scranton, 4 miles, and to Pascagoula, 2 miles, within 30 days. The road connects with the Louisville & Nashville at Scranton. Ch. Engr., W. J. Clark, Moss Point, Miss.

SUWANNEE RIVER.—Surveys have been made for an extension of this railway south of Hudson-on-the-Suwannee to Cedar Keys, Fla. Gen. Supt., Jas. Veit, Jacksonville, Fla.

Projects and Surveys.

ATLANTIC, FLORIDA & GULF.—This company has been organized in Florida to build a railway from Rockledge, on the east coast, in a westerly direction to Bartow, Fla., a distance of about 200 miles. Cassius C. Smith, Vice-Pres., is reported as on his way to Kissimmee, Fla., where headquarters will be established, to go over the route mapped out by the engineers. Mr. Smith has been until recently assistant to the general manager of the Rio Grande Western Ry., at Denver. It is reported that the line will be under construction between Rockledge and Kissimmee at an early date. The Florida Engineering & Construction Co. is reported to be interested.

BIG LAUREL & PANTHER CREEK.—The incorporators of this company met at Selius Grove, Pa., Dec. 13, and elected directors. The company was incorporated Sept. 18 to build a railway between the mouth of the Cherry River and mouth of Panther Creek, W. Va. Pres., W. J. Goetner, Selius Grove, Pa.; Vice-Pres. and Treas., John L. Miller, Sunbury, Pa.; Secy., J. M. Boyer, Selius Grove, Pa.

CRAIGSVILLE & CAMDEN TRAM-ROAD.—Incorporated in West Virginia, Dec. 15, to build a tramroad between Camden-on-Gauley and Little Union Church, W. Va.; capital stock, $100,000, commencing with $3,200; incorporators, Geo. H. Alderson, Enon, W. Va.; A. J. Arbogast, Craigsville, W. Va.; W. D. Huff, Persinger, W. Va.; A. D. Williams and O. F. Williams, Beaver Falls, W. Va., and others; principal office, Craigsville, W. Va.

SAVANNAH RY. & TERMINAL.—Bids are being received by this company, according to reports, for building three miles of railway. Address Savannah, Ga.

STURGIS BELT LINE.—Press reports from Sturgis, Ky., state that L. C. Garrett, Chicago, and Pres. Hopkins, of the St. Louis Construction Co., are examining the route for a railway to run from the Rock Springs coal fields, eight miles from Sturgis, through that city, and thence across the Ohio River to Caseyville and Cypress Junction, Ill. A similar road was projected in the summer by the Sturgis Belt Line Ry. Co. Supt., John H. Mullin.

SUGAR CREEK, PACK'S BRANCH & PAINT CREEK.—The incorporation of this company was noted in our issue of Nov. 29. E. Smith, Alderson, W. Va., one of the incorporators, states that the road will be 43 miles in length, but that the necessary capital for the construction is not yet all secured.

Northwest—Existing Roads.

DULUTH, RED WING & SOUTHERN.—Wm. Danforth, Ch. Engr., Red Wing, Minn., writes us in regard to the reported steps for resuming work on this railway that no work has been done during the year on new construction and that no definite arrangements have been made for the future. The road is projected from Duluth to Sioux City, 423 miles, and is completed between Red Wing and Zumbrota, Minn., 25 miles. The next construction will probably be to complete the road to Duluth.

GREEN BAY, WINONA & ST. PAUL.—It is reported that a branch will soon be built from Scandinavia to Waupaca, Wis.

MINNEAPOLIS & ST. LOUIS.—Press reports state that surveyors of this company are at work between New Ulm and Mankato, Minn., and it is thought that this means an extension through to a junction with the Watertown division of the M. & St. L.

MITCHELL & McCLURE.—The Duluth "Tribune" states that Mitchell & McClure have commenced work on their logging railway to connect with the Northern Pacific at Barker, and that about eight miles of track will be laid this winter.

ST. LOUIS & EASTERN.—It is reported that the contractors who are building an extension of this railway from Marine, Ill., to Alhambra expect to complete the work early next year.

SOUTH ST. PAUL BELT.—A correspondent writes us that this company has now under contract and partly constructed a line of railway from St. Paul Park, connecting with the C., M. & St. P. and C., B. & N. Rys. at that place, to the St. Paul union stockyards on the other side of the Mississippi River at South St. Paul. This road is four miles long, including the bridge over the Mississippi River. The grading of the east approach is being done by F. N. Truax, of St. Paul Park, and the grading on the west side of river by A. S. Weymouth & Co., South St. Paul. Charles Stone, of St. Paul, is contractor for substructure of Mississippi River bridge, which is nearly completed. The Pittsburg Bridge Co. has the contract for the steel superstructure, and shipments have already been begun. The road will be open for operation by April 1. Chas. F. Loweth, St. Paul, is the chief engineer.

Projects and Surveys.

EASTERN NEBRASKA & GULF.—Press reports state that the officers of this company, which secured a right of way across the Winnebago reservation in Nebraska at the last session of congress, announce that they have completed arrangements for the construction of the first section of the road, 40 miles in length, across the reservation southwest of Sioux City, Ia. Work will be commenced at once, and the first section will be in operation by the spring. The company was incorporated nearly a year ago. Ch. Engr., F. W. Kimball, Austin, Minn.; Gen. Man., W. C. McNamara, Sioux City, Ia.; Pres., A. W. Swanitz, New York.

ELM CREEK, SPRING CREEK & SALT RIVER.—Organized at Odell City, S. Dak., to build a railway, the construction of which it is claimed will be commenced very soon; capital stock, $300,000; incorporators, Fred Schuler, W. M. Thom and Sam Odell.

ILLINOIS COAL.—Incorporated in Illinois to build a railway from Danville through the counties of Vermilion, Iroquois, Kankakee, Will and Cook to Chicago, with branches to Danville and Joliet; capital stock, $1,000,000; incorporators, Benjamin Crawford, John Beard, John G. Holden, Louis Piatt and Chas. A. Fera, all of Danville, Ill.

PADUCAH, HARRISBURG & CHICAGO.—Steps are being taken to secure aid for the construction of this projected railway from Paducah, Ky., north through Illinois. Pres., J. H. Hildreth, Chicago; Simon S. Barber, Eddyville, Ill., is also interested.

PRENTICE, ANTIGO & EASTERN.—Several counties in Wisconsin have voted aid to this railway and it is reported that the construction will be commenced at an early date. The road will connect with the Soo and Wisconsin Central lines at Prentice and extend through Merrill to Antigo and thence east to some place in Green Bay. Pres., S. Heineman; Secy., H. H. Foster, both of Merrill, Wis.

ST. LOUIS, PERRY & CHICAGO.—Organized in Illinois to build a railway from Pittsfield, by way of Alton, to St. Louis; incorporators, G. W. Witham, F. L. Hall, Perry, Ill.; L. W. McManon, Griggsville, Ill.; C. E. Bolin, Milton, Ill.; J. M. Piper, and others of St. Louis. Surveys have been commenced, according to reports.

SHEBOYGAN, ST. PAUL & CENTRAL.—A press report from Sheboygan, Wis., state that Glann & Bick, of Toledo, O., who have the contract for the building of the Sheboygan, St. Paul & Central R. R., have sublet the same to the F. C. Crowley Construction Co., of Chicago, and work on the road is expected to be commenced soon.

WISCONSIN.—The Milwaukee "Sentinel" states that there is a prospect that Cambridge, Wis., will have a railway line by April 1, 1895, to be built on the grade which was made in 1886. At that time a company was formed which graded the roadbed for a line from the main line of the Chicago & Northwestern at London, a distance of three miles, to the village, but the work of construction was stopped by an injunction. A new company has been formed consisting of Ole Bilstad, H. A. Olson and J. H. Townsend, of Cambridge; Ole Wigdale, of Fort Atkinson, and C. Olson, of Stoughton. They are now negotiating with Northwestern company to loan the iron, in which case they will at once proceed to equip the road and have trains running before April 1 next. Secy. and Treas., H. A. Olson; Pres., Ole Bilstad, both of Cambridge, Wis.

Southwest—Existing Roads.

CHOCTAW, OKLAHOMA & GULF.—The following is a corrected list of the subcontracts awarded by Geo. S. Good & Co., South McAlester, Ind. T., for the 122 miles of work between that city and Oklahoma City, as noted in our issue of Dec. 6:

East from Oklahoma City.

Sections	1 to 6,	J. W. Powell, Council Grove, Okla.
"	7 " 12,	John A. O'Keefe, Chicago, Ill.
"	13 " 32,	Ware, Maney & Co., Sedalia, Mo.
"	33 " 42,	St. Joseph (Mo.) Construction Co.
"	43 " 47,	A. F. Burke, Chicago, Ill.
"	48 " 50,	T. S. McCoy, Wichita, Kan.
"	51 & 52,	Ware, Maney & Co., Sedalia, Kan.

West from South McAlester.

Sections	11 & 12,	J. H. Barrett, San Antonio, Tex.
"	13 " 14,	Conelly & Doyle, St. Louis, Mo.
"	15, ..	H. Hansen, San Antonio, Tex.
"	16, ..	W. H. Corder, Burnett, Tex.
"	17 to 19,	Dowling & McGunnigle, St. Louis.
"	20 & 21,	J. E. Collins, Hot Springs, Ark.
"	22, ..	Ward & Elliott, So. McAlester, Ind.
"	23, ..	Wm. O'Connor, St. Louis, Mo.
"	24 & 25,	Ferguson Cont'g Co., Evansville, Ind.
"	26, ..	Pat. Rail, South McAlester, Ind. T.
"	27, ..	Jas. Crowley, Kansas City, Mo.
"	30 & 31,	J. H. Howard, Springfield, Ark.
"	32 to 35,	Joseph Meehan, Round Pond, Okla.
"	37 " 40,	A. J. Yawger & Co., Bucyrus, O.
"	41 " 43,	A. W. Scott, Kansas City, Mo.
"	44 " 53,	Ferguson Contract'g Co., Evansville.

Masonry: West from South McAlester.

Sections	11 to 16,	Gleason & Donohue, So. McAlester.
"	17 " 19,	McNerney Bro., Carthage, Mo.
"	20 " 22,	Broffit & Cleland, So. McAlester.
"	23 " 24,	Jas. Crowley, Kansas City, Mo.
"	25 " 31,	N. Gosney & Co., St. Louis, Mo.

LA PORTE, HOUSTON & NORTHERN.—It is stated that application will be made to the legislature to pass a special bill permitting the consolidation of the La Porte, Houston & Northern and the North Galveston, Houston & Kansas City railways, and to change the name to the Galveston, La Porte & Houston R. R. Four miles of the La Porte, Houston & Northern have been regraded since the present owners took charge, and track is being laid from the present terminus of the road to La Porte, which place will be reached in January. A preliminary survey is also being made from La Porte to North Galveston, and on that survey the line of the road will be definitely located.

MISSOURI, KANSAS & TEXAS.—A press report from San Antonio, Tex., states that this company has completed all arrangements for the early construction of the extension from San Marcos to San Antonio, 50 miles, as shown by the filing of an amendment to its charter, providing for the building of the extension. The final survey of the line has been completed and the necessary grading outfits will soon arrive.

Projects and Surveys.

DALLAS TERMINAL & UNION DEPOT.—Incorporated in Texas to build a terminal railway at Dallas; capital stock, $500,000; incorporators, W. C. O'Conner, J. C. O'Conner, W. O'Conner, Barnet Gibbs, Phillip Sanger and others. The proposed work is estimated to cost $700,000, and efforts are being made to secure a cash bonus of $37,000. The company has been granted authority by the railroad commission to issue $500,000 in bonds. It is reported that the Cotton Belt will build a 12 mile extension into the city, and the Rock Island, the Fort Worth & Denver and other roads will also come to the city as soon as the terminal railway is built.

GALVESTON & GREAT NORTHERN.—Incorporated in Texas to build a railway from Galveston to Denison; capital stock, $1,000,000; incorporators, Edward Roemer, New York; P. J. Doherty, R. C. Shearman, Geo. Braun, Sam Starr and others, of Denison, Tex. The citizens of Denison are reported as to give the company a cash bonus of $50,000, together with the graded right of way from Bonham to Denison; also right of way through Denison to Red River, with terminal facilities, etc., in Denison. The road is projected to extend from Galveston, Tex., to Niobrara, Neb., and was noted in our issues of Nov. 22 and 29. Pres. Roemer is reported as stating that the construction will soon be commenced at Galveston.

KANSAS CITY, OKLAHOMA & SOUTHERN.—Robt. Martin, Pres., has returned from England, where he has been for about six months arranging for the construction of this railway, and is reported as stating that over $1,500,000 of stock has already been sold and that the construction will be commenced about April 1.

LITTLE ROCK & PACIFIC.—Gov. W. M. Fishback, Pres., writes us that this railway is projected from Little Rock, through Dardanelle and Paris to Fort Smith, with a branch to Wister Junction, Ind. T., a total distance of 230 miles. Nothing definite has yet been decided as to the construction, but the cities and towns through which the road will pass are considering propositions.

OKLAHOMA CENTRAL.—L. F. Hoops, Parker, Okla., writes us that this company will purchase ties and steel and build its road without awarding grading contracts. The route is from Arkansas City, Kan., to Eagle Pass, Tex., and from Hunnewell, Kan., by way of Parker, Okla., to Texarkana, Tex., a total projected length of 1,000 miles. The line has been located from Hunnewell to Parker and some grading done. Condemning right of way will be commenced this week. The capital for the construction has been mostly secured, and the company will pay as it goes. It is expected that the line from Hunnewell, Kan., to Parker, Okla., will be completed by July 1, 1895. Pres., H. Stout, Parker, Okla.; Ch. Engr., Geo. H. Brett, New Ponca, Okla.

RAYNE & CHURCH POINT.—A company has been organized at Rayne, La., to build a railway to Church Point; capital stock, $250,000; Pres., Hampton Story; Vice-Pres., Homer Barrousse; Secy., Emile Daboval, Jr.; Treas., R. C. Webb; Engr., Welman Bradford. It is stated that the preliminary survey will be made at once.

RIO GRANDE NORTHERN.—The San Carlos Construction Co. was incorporated last week to build this railway, according to the reports; capital stock, $150,000, of which $75,000 is paid in; Pres., Frederick Gwinner, Allegheny, Pa.; Vice-Pres., A. Johnston; Treas., John P. Ober; Secy., A. S. Straub; Gen. Man., F. Gwinner, Jr.; other directors include C. L. Straub, T. F. Straub and J. M. Forse, Pittsburg, Pa., and Augustine Beckert, Allegheny, Pa. This railway will extend from Chispa, Tex., on the Southern Pacific, to the San Carlos coal fields, 26 miles. G. L. Marshall, Ch. Engr., El Paso, Tex., is now making the final surveys, and it is stated that the construction will be commenced early next month.

Rocky Mt. and Pacific—Existing Roads.

SAN PETE VALLEY.—A correspondent writes us as follows: This narrow gage railway was built in 1882 from Nephi, Utah, to Wales, Utah, 25 miles. The coal mines at Wales were mostly abandoned in 1884, and the track was torn up for 5 miles back to Draper Junction, and from there laid to Moroni, 23½ miles from Nephi. The road was completed to Chester in 1884, 27 miles from Nephi. In 1893 it was completed to Manti, 42 miles from Nephi. The company, in July, 1894, opened some excellent coal mines at Morrison, some 8 miles beyond Manti, completing the road to there in September, and as it could make no traffic agreement for tracks to Salt Lake City, its natural market, it resolved to extend its own line there, making it broad gage. The road from Moroni to Manti is over an easy country, so no new location will have to be made to broaden the gage. The extension from Manti to Morrison was located with a view to the same. From Moroni to Nephi only a portion of the old line can be used. Surveys were begun on Nov. 8 for the extension to Salt Lake City, beginning at Moroni. O. R. Young, of Salt Lake City, is chief engineer and has a party of 13 men at work. The maximum grade of the old line from Moroni, on the east side of the divide, between San Pete and Salt Creek valleys, is 1.58%, maximum curve 6°. The distance to summit is 13¼ miles, and the elevation of same 6,300 ft. above sea level. From the summit down to Nephi is 10¼ miles, with a descent of 1,185 ft. The operated line on this side of the summit, in the Salt Creek Canon, has a maximum grade of 3.7%, with much of it 3% and 3.25%. The alignment is excellent, the road following the bottom of the canon all the way. The preliminary survey for the new line has a maximum grade of 2.3%, and it is thought that 9° to 10° will be the maximum curve. The line is run on a supported grade of 2.3% for most of the distance in the canon, and also outside of the same along the slope of the foot-hills northeast of Nephi until headed to the northwest, when 1% is the maximum. The town of Nephi will be on a spur or Y from the main line, it being necessary to keep the line on the foothills to limit the grade; besides which, Nephi is too far south to be on a through line to Salt Lake City. In the canon the line is developed as much as possible with the maximum curve kept in view, to get down the steeper parts of the descent. About two-thirds of it there is hill-side work. North of the canon 4° to 6° will be the maximum curve, and 1% the maximum grade. The line, on Dec. 6, was completed to the Santaquin hill, 4 miles south of Santaquin, in Utah county. The new line on east side of the summit down to Moroni will have maximum grade of 1.4%, and maximum curve of 4° to 6°. The extension from Manti to Morrison is essentially a coal road for the last three miles, and has a maximum grade of 4½%, and maximum curves of 12° and 15° for this portion.

UNION PACIFIC, DENVER & GULF.—Press reports from Trinidad, Colo., state that the construction of extensive shops in that city will be commenced this week by this company.

Projects and Surveys.

COLUMBIA RIVER & ASTORIA.—Later information has confirmed the press report published in our issue of Dec. 6 stating that A. B. Hammond had signed a contract to construct this railway from Astoria to a connection with the Northern Pacific at or near Gobel, Ore., 60 miles. The contract was signed by A. B. Hammond and E. L. Bonner, of Missoula, Mont., and the construction is to be commenced by April 1.

SUMMIT MINERAL.—A. G. Lombard, Ch. Engr. and Gen. Man., Helena, Mont., writes us that surveys have been made and 90% of the right of way secured for this railway. The route is from Rimini, Mont., to the Ontario mines, 20 miles. A five-year contract has been made with the principal mining companies, the contract with one company alone amounting to $40,000 for freight tariff per year. Contracts for building the road will probably be awarded next year. Pres., Cornelius Hedges.

Foreign.

SYRIA-OTTOMAN.—The contract for this railway was awarded about a year ago to Huss, Townsend & Co., Rookery Bldg., Chicago. The railway is being built by English capitalists, and will extend from Acre and Haifa to Damascus, a distance of about 150 miles. The first section of the line, which crosses the Jordan, has been completed and the construction has been suspended until next summer. The steel rails used on the road were purchased in England, the ties came from Norway, the engineers are American and English, and A. T. Wilcox, Chicago, is superintendent of the construction. The fellahs of the country, Arabs, Jews, Maronites and Druses, are employed as laborers, the men receiving 30 cts. a day and the women 15 cts. Geo. M. Huss, who has just returned to Chicago, is reported as stating that the natives are unable to use anything but their wooden sticks to loosen the earth, which is then scraped with hoes into baskets and conveyed on their heads. The syndicate that is building the road labored 20 years before it could get a concession from the Sultan to build it, and this concession requires, among other things, that every person connected with the project shall wear the national headdress, a fez, while in Palestine.

STREET AND ELECTRIC RAILWAYS.

PORTLAND, ME.—Press reports state that the legislature will be asked for a charter for an electric railway to run from Portland along the Cape shore for 15 miles in a southeasterly and southwesterly direction. The petitioners are F. Coleman Boyd, New Haven, Conn.; J. S. Winslow, J. H. Boyd and A. R. Boyd.

SKOWHEGAN, ME.—The Skowhegan, Madison & Athens St. Ry. & Power Co. has been organized to build an electric railway from this town to Hayden Lake, with branches to Madison, East Madison and Athens, a distance of 19 miles. The selectmen have called an election to vote on the question of granting a franchise. J. P. Oak, T. H. Anderson and J. W. Gould are interested.

SPRINGFIELD, VT.—H. B. Holmes writes us that a charter has been granted for a street railway but no organization has yet been effected.

STOWE, VT.—C. L. McMahon writes us that surveys have been made for the Mount Mansfield Electric R. R. line from Stowe to Waterbury, a distance of 10 miles, and a charter granted by the legislature. The capital stock has not yet all been subscribed. The contracts for the construction will be awarded early in the spring.

WARE, MASS.—F. S. Coolidge, Pres. Gardner Electric Ry. Co., has been looking over a proposed route with a view to building an electric railway to connect this place with Gilbertville and Warrens. The Gilbert Mfg. Co. is encouraging the project.

NEWINGTON, CONN.—The Central Ry. & Electric Co. has petitioned for permission to extend its line to Hartford. Secy., C. S. Landers.

BINGHAMTON, N. Y.—J. B. Landfield, Pres. Binghamton, Lestershire & Union R. R. Co., writes us that nothing will be done before spring in regard to the proposed six-mile extension to Union.

BUFFALO, N. Y.—The "Commercial" states that arrangements are being made to incorporate a company with $100,000 of capital stock to build an electric railway from Fort Erie, Ont., to Port Colborne, Ont., taking in all the immediate resorts on the lake shore. Men from Buffalo, Toronto and these towns are interested in the project.

ISLIP, N. Y.—The Cross Island Trolley R. R. Co. has been granted a franchise by the town board for its proposed railway from Long Island Sound to the ocean, probably from Northport to Brentwood, Islip, Bay Shore and Babylon.

NEWTOWN, N. Y.—The Brooklyn, Newtown & Bowery Bay Ry. Co. has been granted a franchise to construct an electric railway from Greenpoint, L. I., to the Lutheran Cemetery and Bowery Bay, a distance of 10 miles. Work will begin as soon as possible. Pres., Al. Combes, Newtown, L. I.; Ch. Engr., E. B. Gallaher, 253 Broadway, N. Y. Mr. Gallaher is also chief engineer of the Peekskill State Camp & Mohegan R. R., now under construction.

NEW YORK, N. Y.—The aldermen have granted a franchise to the 42d St., Manhattanville & St. Nicholas R. R. Co. to build a horse car line on West 86th St. from the Boulevard to Central Park.

NYACK, N. Y.—J. H. Browning, Pres. Northern New Jersey R. R. Co., is interested in a project to build an electric railway from the station of the Northern road to the Hook mountain.

OGDENSBURG, N. Y.—The Ogdensburg St. Ry. Co. has completed surveys preparatory to equipping the line with electricity. The company operates five miles of road. Gen. Man., H. B. Howard.

OSWEGO, N. Y.—It is reported that the Oswego St. Ry. Co. proposes to make several extensions of its line before spring and that efforts will be made to extend the line to Minetto.

FORT LEE, N. J.—The Bergen County Traction Co. has been incorporated with a capital stock of $500,000, commencing with $35,000; incorporators, Leon Abbett, Hoboken; John A. Dempsey, New York, and Charles F. Colladay, Philadelphia.

RAHWAY, N. J.—The Rahway St. Ry. Co. has been granted a franchise to equip its line with electricity, the work to be completed in six months.

SEA ISLE CITY, N. J.—Press reports state that the council has passed on first reading an ordinance granting to Philadelphia capitalists a franchise for a water-works plant. The same capitalists will also build a trolley road the length of the island.

PHILADELPHIA, PA.—Plans are being prepared by the chief engineer of the Philadelphia Traction Co. for equipping its Market St. line with electricity, the cable system being used at present. It is proposed also to extend the line this winter to Spring Garden and Wallace Sts. Vice-Pres., Geo. D. Widener.——The Fairmount Park Transportation Co. has been incorporated to construct a railway in Fairmount Park; capital stock, $2,000,000, commencing with $10,000; incorporators, J. B. Peddle, Woodbury, N. J.; J. D. Yarrow and R. F. Bower, Philadelphia.

PITTSBURG, PA.—Plans have been completed for the construction of the Second Ave. St. Ry. Press reports state that the main line will extend from Market St. to McKeesport, by way of Glenwood, Watsontown and Dravosburg, a distance of 10½ miles, with another main line from Market St. to Turtle Creek, by way of Glenwood, Ruskin, Braddock, Brinton and East Pittsburg. A branch will cross the river to Homestead and furnish a local service, and a second branch will run on the south side of the river from Homestead to the city line. The latter will be ultimately continued to the center of the city, according to reports. Pres., J. D. Callery.——The directors of the Castle Shannon R. R., a narrow gage steam line six miles in length, have decided to convert this line into an electric road. The change from steam to electricity was agreed upon to checkmate the projectors of a new line to parallel the Castle Shannon road. The road will be a double track line of standard gage. New cars will be added and 15 new stations built. The superintendent has been directed to advertise for bids for reconstructing the road.

WEST CHESTER, PA.—Press reports state that J. J. Patterson, Lancaster, Pres. Lancaster & Philadelphia Electric Ry. Co., says that work is to be commenced on the line between West Chester and Philadelphia in a few days. He also states that a branch line will be built running through Marshallton, Unionville, Kennett Square, Toughkenamon and Avondale to Oxford.

ANNAPOLIS, MD.—The contract for constructing the Annapolis, Bay Ridge & Brighton Beach Electric Ry. has been awarded to Henry Yewell Bready, successor to Smith & Bready, Fayette and North Sts., Baltimore. The construction will begin Jan. 1. All communications for electric equipments, track materials, power house machinery, etc., should be addressed to the contractor.

BALTIMORE, MD.—Frank H. Sloan, Ch. Engr. City & Suburban Ry. Co., 512 Equitable Bldg., writes us that 50 miles of the 75 miles of electric system projected by this company have been completed. Next year the Sparrows Point extension of six miles is to be constructed and the Catonsville horse railway, 13 miles long, will be equipped with electricity. It is proposed to extend the Catonville line to Ellicott City, a distance of four miles. Pres., Nelson Perin.——The contract for the electrical equipment for the belt tunnel has been awarded to the Maryland Steel Co., at about $80,000, according to local papers.

BALTIMORE, MD.—A correspondent writes us that the Baltimore, Severn Park & Annapolis Electric Ry. Co. has been incorporated by Thomas C. Musgrove, Philadelphia; H. Y. Bready, D. S. Collect, Benj. F. Simons and G. H. White, Baltimore. Baker & Boehme are the attorneys. Henry Yewell Bready, Gen. Man. and Ch. Engr., Chesapeake Bank Bldg., will have charge of the construction work. The line will be single track, and will be about 25 miles in length. The power house will be at Severn Park and will contain six generators of 500 HP. each. The survey will begin Dec. 20 and the construction commence in the spring. There will be 1,250 octangular poles, dressed and painted with two coats of oil paint, and to be not less than 10 ins. in diameter at the small end. The track to be used will be section No. 91 of the Pennsylvania Steel Co.'s, weighing 80 lbs. per yd.

WASHINGTON, D. C.—The Columbia R. R. and the Washington & Georgetown R. R., both cable railways, have applied for franchises for extensions.

NATCHEZ, MISS.—The Natchez Electric St. Ry. Co. has been formed with a capital stock of $100,000, with privilege of increasing it to $250,000.

MANSFIELD, O.—It is reported that a company will soon be incorporated to build an electric railway from this place to Ganges, Rome, Shenandoah, Savannah and Wellington, where it will connect with the Cleveland, Cincinnati, Chicago & St. Louis Ry. N. E. Harrout, Ashland; T. Y. McCray and Nelson Ozier are interested.

MOUNT VERNON, O.—The commissioners of Knox county have granted a franchise to the Mount Vernon & Walmonding Ry. Co. The proposed railway will be 20 miles in length.

WARREN, O.—C. F. Clapp, Pres. Mahoning Valley Electric Ry. Co., writes us that a franchise has been granted this company for a line from Niles to Youngstown, a distance of 7½ miles. Capital has been subscribed but no contracts have yet been awarded. The line is to be completed by July 1.

ANDERSON, IND.—Press reports state that the directors of the new Gas Belt Electric Ry., which is to run from Indianapolis to Marion, by way of Anderson, Alexandria and other gas belt cities, have located the two power houses at Jonesboro and Anderson. They are to be big concerns, and each will furnish power for 40 miles of the line. C. E. Loss & Co., Chicago, are said to have the contract for building the entire road.

COLUMBUS, IND.—Press reports state that John S. Crump, who owns and operates seven miles of electric street railway in this city, has purchased the Seymour St. Ry. and the dummy line to Rockford. He will at once tear up the track and move the rails and ties to this city, to extend the lines of his home plant.

TERRE HAUTE, IND.—The People's Electric Ry. Co. has been incorporated with a capital stock of $100,000; directors, A. J. Crawford, Edwin Ellis and R. G. Jenckes.

CHICAGO, ILL.—The Chicago & Worth St. Ry. Co. has been incorporated to construct an electric railway in South Chicago and suburban towns in that vicinity. Press reports state that the cars are to be fitted with a lately invented storage battery. It is likely that ground will be broken in about a month. Capital stock, $2,000,000; incorporators, W. W. Beatty, J. H. Smith and M. Skinner.

WATSEKA, ILL.—Col. A. A. Spitzer, Richmond, Va., is interested in a projected electric railway between this place and Onarga, by way of Crescent City.

DETROIT, MICH.—The Detroit Ry. Co. has been incorporated with a capital stock of $1,000,000; incorporators, Green Pack, Albert Pack, H. A. Everett and C. W. Wason.——Right of way is being secured for an electric railway from this city to Birmingham, Pontiac and Orchard Lake, and other places in Oakland county. A franchise has been obtained in Bloomfield township and a similar application is pending in Royal Oak township. E. W. Voigt, Detroit; S. W. Smith, Pontiac, and J. A. Randall, Detroit, forming the Voigt-Randall syndicate, are at the head of the project.

ROYAL OAK, MICH.—Press reports state that petitions have been presented to the council by Messrs. Hendrie, Baker and Baldwin, representing one company, and by Messrs. Randall, Smith and Voigt, representing another, for an electric street railway franchise. While the sentiment of the board is strongly in favor of having one of the companies build a road, it has not yet been decided which company will have that privilege. It will be acted upon at the next meeting of the council.

WAUKESHA, WIS.—William Powrie, Engr. Waukesha Beach Electric Ry. Co., writes us that the work of ballasting the road has commenced, C. E. Loss & Co., Chicago, having the contract.

IOWA CITY, IA.—It is reported that this city is ready to pay a bonus of $5,000 to any company that will construct an electric railway in the city. Address the Improvement Committee.

MASON CITY, IA.—S. C. Sale writes us that no action has yet been asked on the part of the council for the construction of a proposed electric railway. A charter was granted to a company some time ago, but by non-compliance it was forfeited.

WYMORE, NEB.—Alex. Stewart, Pres. Wymore & Blue Springs Transit Co., writes us that the Wymore & Blue Springs Transit Co., noted Dec. 6 as incorporated, is a reorganization of the Wymore & Blue Springs Ry. Co.

CARTHAGE, MO.—Press reports state that D. R. Powell, St. Louis, has bought at trustee's sale the Joplin Electric Ry., for $35,000, for the Carthage, Webb City, Joplin & Galena Ry. Co. The road purchased was bonded for $150,000, held by the Union Trust Co., which was represented at the sale by Judge George A. Madill. It is believed the new company will at once extend the road to Galena, Kan., and connect with the road soon to be built from Carthage to Carterville and Webb City.

SANTA ANA, CAL.—The Orange county chamber of commerce has appointed H. A. Peabody and Frank Ely to present a petition to the trustees to grant a further extension of time to the Santa Ana & Westminster Ry. Co. for constructing its line through the city.

QUEBEC, QUE.—The railway committee has passed the Hull Electric Co.'s bill for building an electric railway in Ottawa county.

OTTAWA, ONT.—It is reported that the Kingston & Ottawa Ry. Co. is considering the question to equip its proposed line with electricity. Pres., C. F. Gildersleeve, Kingston.

BRIDGES.

AUBURN, N. Y.—The supervisors of Cayuga and Seneca counties are considering plans for constructing several new bridges, including one to replace the old free bridge that now connects the two counties.

BUFFALO, N. Y.—The board of public works has been directed to advertise for bids for a new iron bridge and abutments on Michigan St. M. S. Hubbell, Cy. Clk.

COATESVILLE, PA.—It is reported that the Pennsylvania R. R. Co. intends to build a new bridge at this place, 100 ft. south of the present structure. W. P. Worth & Bros. wanted the site for their tube works, and will contest the matter.

PHILADELPHIA, PA.—Bids are asked by the Pennsylvania R. R. Co. until Dec. 28 for the masonry work for the new bridge across the Delaware River. The contract for piling has been awarded.

SCRANTON, PA.—Joseph P. Phillips, Cy. Engr., writes us that the following bids were received Dec. 13 for the construction of the superstructure of the Roaring Brook bridge, (1) being the bid for asphalt floor, and (2) for wood floor:

	1.	2.
Union Bridge Co., Athens, Pa.....	$109,818	$80,740
Groton Bridge Co., Groton, N. Y.....	95,552	66,985
Variety Iron Works, Cleveland, O....	110,221	77,720
King Bridge Co., Cleveland, O.....	109,500	75,400
Pennsylvania Steel Co., Steelton, Pa..	89,475	61,950
Passaic Roll. Mill Co., Paterson, N. J.	108,730	79,170
Wrought Iron Bridge Co., Canton, O..	95,600	70,300
Edgemoor B. Co., Wilmington, Del...	93,950	66,600
Youngstown B. Co., Youngstown, O..	100,000	72,918
Chicago Bridge & I. Co., Chicago, Ill..	97,500	67,000
Massillon Bridge Co., Massillon, O....	102,570	71,033
Nelson & Buchanan, Chambersb'g, Pa.	110,000	76,000
New Jersey S. & I. Co., Trenton, N. J.	115,631	78,334
Penn Bridge Co., Beaver Falls, Pa...	98,000	71,000
Horseheads B. Co., Horseheads, N.Y.	100,575	88,600
Phoenix Bridge Co., Phoenixville, Pa.	87,345	64,600

MERIDIAN, MISS.—Bids are asked until Jan. 7 for constructing a bridge across Toomsaba Creek on the Marion and Livingstone road. B. V. White, Clk.

CIRCLEVILLE, O.—Bids are asked until Dec. 28 for the erection of an iron truss bridge, single span of 130 ft. and 18-ft. roadway. T. J. Morris, County Audr.

MARIETTA, O.—The railway company proposes to include a footwalk in rebuilding the bridge across the Muskingum River at an additional cost of $3,000, according to reports.

TOLEDO, O.—Bids are asked until Jan. 7 for constructing a bridge, consisting of stone substructure and an iron or steel superstructure across Swan Creek, at Perry St. L. P. Harris, Cy. Clk.

CHICAGO, ILL.—The drainage board has voted to build a bridge over the canal on a road to Lockport upon the petition of residents of Will county.

SUPERIOR, WIS.—The council is considering an ordinance to construct four bridges across the tracks of the Eastern Ry. Co. of Minnesota.

ST. PAUL, MINN.—The aldermen have voted to take immediate steps for the building of a new bridge on Como Ave., estimated to cost about $50,000. The street is 100 ft. wide.

DES MOINES, IA.—Frank Pelton, Cy. Engr., writes that he is preparing plans for an iron bridge, 100-ft. span and stone abutments. Bids will probably be opened in January.

YANKTON, S. DAK.—E. D. Palmer, Cy. Engr., writes us that a plan has been submitted by the Missouri Valley Bridge Co., Leavenworth, Kan., for constructing a bridge across the Missouri River at this place. There is no doubt about the bridge being built next year. Arrangements for the necessary funds are now being made. It will not be expensive work, as it is but little more than 30 ft. to solid bottom.

FORT WASHAKIE, WYO.—It is reported that a bridge to cost about $3,000 will be built across the Wind River, north of this place.

LEAVENWORTH, KAN.—Bids are asked until Jan. 7 for constructing six county bridges. J. W. Niihaus, County Clk.

JEFFERSON, MO.—The directors of the bridge company are considering a proposition of A. J. Tullock, Pres. Missouri Valley Bridge Co., Leavenworth, Kan., for the construction of a low drawbridge instead of the proposed high bridge across the Missouri River at this place. Efforts are to be made to secure a charter for such a bridge, so it can be constructed next year.

GALVESTON, TEX.—Press reports state that the plans for the new bridge over the bay are being prepared by the engineer and will be submitted to a board of local engineers in a short time for approval. The piers are to be of stone. There are to be two tracks and the material is to be of the most substantial character. The idea of the projectors is to build an approach to the city over which trains can be run with perfect safety at a speed of 30 miles an hour.

WATER-WORKS.

BAR HARBOR, ME.—The contract for laying the pipe for the extension of the works has been awarded to Franklin A. Snow, Boston, according to reports.

PORTLAND, ME.—The Municipal Water-Works Co. has been incorporated to manufacture water-works supplies and to own works in Cumberland county; capital stock, $200,000, of which $125 is paid in; Pres., T. C. Woodbury, Portland; Treas., E. H. York, Portland.

BOSTON, MASS.—The state board of health has been investigating a supply for the metropolitan district, which includes some 26 cities and towns within a radius of 10 miles from this city. It is reported that as a result of over a year's investigation, the Nashua River will be recommended as a source of supply and a reservoir about seven miles long will be provided just above the town of Clinton. An aqueduct nine miles long would connect this with the present Sudbury supply and the present daily supply of 9,000,000 gallons would be increased to 63,000,000; estimated cost, $17,400,000.

GROTON, MASS.—A. H. Torrey, Town Clk., writes us that Milo H. Shattuck, Dr. J. G. Park and F. F. Woods have been appointed to secure surveys and estimates and to report at the April meeting.

MILLERS FALLS, MASS.—John A. Taggart, A. P. Cary and Samuel Sawyer, appointed some time ago by the citizens of Montague and Erving, have petitioned for a charter for the Millers Falls Water Supply District, with authority to put in works and to issue $20,000 in bonds.

NEWTON, MASS.—The aldermen have authorized the water board to purchase pipe and castings to cost $17,000.

NORTH ATTLEBORO, MASS.—The commissioners have petitioned for authority to take a supply from Ten Mile River, as recommended in the report of Percy M. Blake. The estimated cost of this supply is $28,300 and of laying mains in Plainville $21,403.

PEABODY, MASS.—The board of trade is agitating the question of an additional supply, which was authorized several years ago. J. B. Thomas is interested.

WORCESTER, MASS.—F. A. McClure, Cy. Engr., writes us that no plans have yet been made for the proposed new supply.

ALBANY, N. Y.—The water committee has adopted plans for the foundations for the second pump; estimated cost, $15,000.

ALFRED, N. Y.—The "Sun" urges that steps be taken to secure works.

CALEDONIA, N. Y.—F. A. Christie, Cy. Clk., writes us that nothing has been done toward works except an effort to secure a water supply of suitable quality and sufficient quantity.

CANASERAGO, N. Y.—It is reported that a company is considering the question of putting in gravity works in this village, and that the residents are much in favor of the project.

CORNWALL, N. Y.—The trustees have authorized D. E. Pope to secure estimates for works.

FORESTVILLE, N. Y.—It is reported that the right of way is being secured for laying mains and that $18,000 in bonds will soon be issued. W. H. Parsons, Clk.

NIAGARA FALLS, N. Y.—The Niagara Falls Water-Works Co. is considering plans for a filter plant to purify its entire supply. This company supplies the southern part of the city.

MONROE, N. Y.—Contracts for works have been awarded as follows: Pipe, valves and hydrants, to R. D. Wood & Co., at $14,303; meter, Neptune Meter Co., $550; labor, etc., E. B. Kay, Bellwood, Pa., $11,213. The bids are published under Contract Prices. Engr., Alexander Potter, New York.

MONTGOMERY, N. Y.—W. L. McKinney, Clk., writes us that a meeting of the citizens has been called for Dec. 22 to discuss the question of works.

PORT CHESTER, N. Y.—The question of municipal works is reported as being agitated, supply to be from artesian wells.

SCHENECTADY, N. Y.—The aldermen are considering the question of the proposed new supply from wells 2½ miles distant. The supply would be pumped to a reservoir; estimated cost, $214,000.

WAPPINGER'S FALLS, N. Y.—The sickness in the village recently is attributed to bad water and drainage, according to reports, and the question of waterworks is again being discussed.

CLAYTON, N. J.—It is stated that the proposed works will be built in the spring.

SEA ISLE CITY, N. J.—The council has passed on first reading an ordinance granting a franchise to Philadelphia parties.

VAILESBURG, N. J.—The question of a water supply is expected to be settled at a meeting next month.

LEBANON, PA.—Bills providing for a supply from the Swatara have passed first reading in the common council.

OIL CITY, PA.—A. M. Breckinridge, Clk., writes us that nothing has been done for new pumps further than for the council to authorize the water board to advertise for bids. The high-service steel tanks are almost completed, and when this service is completed satisfactorily attention will be given to new pumps, for which the money is now in the treasury.

QUAKERTOWN, PA.—The committee recently appointed to investigate the plans for a supply is considering a proposed supply from Bleam's dam, three miles distant. A. H. Kittelman, Chn.

ROCKWOOD, PA.—N. S. Werner, Clk., writes us that the borough will put in works next spring, provided the cost does not exceed the amount for which bonds can be issued; supply from mountain spring; population, 850.

BALTIMORE, MD.—Bids will soon be asked for a supply of 12 to 24-in. pipe, and possibly some 20 and 30-in. pipe, according to reports. Wm. L. Kenly, Ch. Engr.

WINSTON, N. C.—J. O. Magruder, Cy. Engr., writes us that the proposed extensions will cost $44,000. Two new 500,000-gallon Smith & Vaile pumps, two 50-HP. Watertown boilers and a 500,000-gallon Warren filter have been bought and about five miles of mains will be laid and the reservoir improved; no contracts will be awarded.

WAYNESVILLE, N. C.—It is reported probable that the legislature will be petitioned for authority to put in works.

EUFAULA, ALA.—The legislature has been petitioned for authority to buy and operate works and gas and electric light plants.

ELBERTON, GA.—It is stated that the new council will favor an immediate issue of bonds for works and electric lights.

ROCKWOOD, TENN.—It is stated that works will be constructed. C. F. Steinwehr, Cy. Recdr.

HOPKINSVILLE, KY.—It is stated that the council has accepted the proposition of Jesse W. Starr, New York, noted last week, and that a site for a reservoir has been purchased. The plant will include a stand-pipe 110 ft. high and a filter plant.

ASHLAND, O.—J. B. Strawn, Salem, is preparing plans for works.

CLEVELAND, O.—The following bids were received for constructing the 450 ft. of 8-ft. tunnel, noted in our issue of Nov. 22: Philip, Byell & Boepple, $22,092; C. H. & E. H. Kuntz, $29,000; John Gill & Sons, $17,777; Helm & Lehman, $13,300; Waterson & Clague, $34,390; John Mahon, $17,300; W. P. Gaune, $17,762; F. W. Dennert, $19,344; McCarty, Seager, Cook & Read, $22,720; Shailer-Schniglau Co., Chicago, $14,990; A. Onderdonk & Co., $17,250; Edward Cowley, $17,238; W. R. Hannon & Co., $22,900; John Garry, $16,481; D. & G. Griere, $8,700.

DALTON, O.—W. C. Scott, Clk., writes us that a system of some kind will be put in. The town was scorched Sept. 10 and the citizens mean business; population, 700. W. H. Houghton, Chn. Com.

ANGOLA, IND.—The contract for works has been awarded to Henry Marrigold, Lima, O., at $11,937, according to reports.

CORYDON, IND.—W. H. Keller has been granted a franchise and will put in works, according to reports.

MADISON, IND.—Bids are asked until Jan. 1 for a 2,000,000-gallon pumping engine, the contractor to remove the old pump and make all necessary connections. Address the water-works trustees.

SOUTH BEND, IND.—The trustees have reported to the council that a new pumping station in the western part of the city is a necessity, and that it should be in working order by May 1. The question of a supply from wells to be bored along the river at the foot of Michigan St. is being considered.

ALTON, ILL.—Plans and specifications are being prepared for a new filter.

BEMENT, ILL.—The contract for works has been awarded to Fairbanks, Morse & Co., Chicago, at $12,500, according to press reports.

CARBONDALE, ILL.—The water-works ordinance has been passed by the council and it is stated that works will probably be put in immediately.

DUQUOIN, ILL.—The council is reported to have voted to engage an engineer from Buffalo, N. Y., to submit estimates for works.

KNOXVILLE, ILL.—Press reports state that this place will soon have works.

MOUNT PULASKI, ILL.—H. B. Capps, Cy. Clk., writes us that at an election Dec. 11 the citizens voted to issue $9,000 in bonds for works. This will make a start and will be added to each year until the city has a complete system. No other steps have been taken; supply from wells; population, 2,000.

QUINCY, ILL.—Hiram Phillips, Consult. Engr., St. Louis, Mo., has been engaged by the city council to prepare plans and specifications for a complete system of water-works for this city. The plans will call for two 5,000,000-gallon compound duplex condensing pumps, a filter plant, and about 60 miles of mains, and will cost about $400,000. The plans and specifications will be on file about Feb. 1, and bids for the construction will be asked for within a short time thereafter. W. E. Kendall, Chn. Com.

DETROIT, MICH.—The water board is reported about to purchase 5,700 tons of pipe.

FLUSHING, MICH.—Works and an electric light plant are estimated to cost $25,000, according to reports, but A. E. Ransom, Cy. Clk., wrote us recently that no contract will be awarded until spring.

MAUSTON, WIS.—Bids will probably be asked soon for constructing works. A supply has been secured from a well. H. C. Strong, Chn. Com.

DUNLAP, IA.—Bids are being received by the Mayor for pipe and other materials and it is thought that the works will be constructed by the city instead of by contract, as at first proposed. The question of stand-pipe has not been decided.

LISBON, IA.—The contracts for the stand-pipe for the new works has been awarded to Crellin & Lovell, Engrs. and Contractors, Des Moines.

LOGAN, IA.—The committee has reported that the city can issue but $4,986 of additional bonds, and that as this amount would not be sufficient to construct new works, it will be better to improve the old works, which have already cost the city $12,000. John A. Berry, Chn. Com.

MAROUS, IA.—Benj. Radcliffe, Secy. Marcus Water-Works Association, writes us that about 13 hydrants are wanted. The pipe is purchased and partly laid. A tower will be added in the spring.

SIOUX CITY, IA.—The Sioux City Water Supply Co. is reported about ready to advertise for bids for constructing the Morning Side works.

WHITTEMORE, IA.—It is reported that this place will soon have works.

MINNEOTA, MINN.—S. T. Gilbertson, Village Recdr., writes us it is expected that the citizens will vote on the question of works this winter; population, 700.

MONTEVIDEO, MINN.—John O. Anderson, Recdr., writes us that nothing will be done until next spring for works.

LEBANON, KAN.—Horace Winegar, Cy. Clk., writes us that the city has voted to issue $2,000 in bonds for increasing the supply. The present system consists of cisterns which are filled by wind-mill power; population, 600.

TECUMSEH, NEB.—The commissioners are reported as considering plans for a supply from the Nemaha River, as the present supply from wells is inadequate.

CHILLICOTHE, MO.—It is stated that $10,000 to $12,000 will be spent in improving the plant of the Chillicothe Water & Light Co. Van R. Caldwell, Receiver.

INDEPENDENCE, MO.—The Cook Well Co., St. Louis, has been awarded the contract to furnish ten 6-in. wells for the new supply.

RICHMOND, MO.—W. T. Shoop, Chn. Com., writes us that bids will be received until Jan. 1 for the proposed franchise, after which it will be submitted to a vote of the citizens for approval. The city will contract for 50 fire hydrants; population, 3,000.

ST. LOUIS, MO.—Bids are asked by the board of public improvements until Dec. 28 for eight water tube boilers to replace the old boilers at pumping station No. 1, Bissell's Point. The work will cost $65,000 to $70,000.

WAVERLY, MO.—An election was called for Dec. 18 to ascertain the wishes of the people on the question of works. No bonds were to be voted upon.

MOODY, TEX.—The Moody Artesian Well Co. has voted to procure a charter and to receive propositions for putting in works. A well has been sunk.

WACO, TEX.—The Bell Water Co. has been petitioned to erect an additional stand-pipe to hold 150,000 gallons.

LOUISVILLE, COLO.—W. W. McNeff, Clk., writes us that the works will probably be completed this week.

ILWACO, WASH.—H. H. Cory, Cy. Clk., writes us that there has been some talk about a new supply, but that nothing further has been done.

ASTORIA, ORE.—Bids are asked until Jan. 10 for constructing works, as stated in our advertising columns, and also for the purchase of $200,000 in 30-year 5% water bonds. H. G. Van Dusen, Clk. Comn.

BAKER CITY, ORE.—Wm. H. Packwood, Sr., Cy. Clk., writes us that no vote has been taken or ordered on the proposed bonding of the city for $65,000 to procure a new water supply.

MEADFORD, ONT.—Bids are asked until Dec. 28 for the construction of works, each bidder to furnish his own plans and to deposit a check for $5,000. Geo. A. Albery, Town Clk.

SUDBURY, ONT.—Bids are asked until Dec. 29 for the purchase of $30,000 in water-works bonds. Arthur Ferris, Town Clk.

WINNIPEG, MAN.—The latest project for a pure water supply is reported as a scheme for a conduit 60 miles in length to the Winnipeg River. C. E. Chester is the engineer in charge of the construction of the water company's plant. H. W. Ruttan, Cy. Engr.

IRRIGATION.

O'NEILL, NEB.—Press reports state that work is progressing rapidly on the securing of water rights for the irrigation ditch of the Nebraska River Irrigation & Power Co., and the surveyors are about to begin work on the permanent survey, as now practically nothing is in the way of the ditch being constructed.

NEW COMPANIES.—Fair View Land & Water Co., Loveland, Colo.; $20,000; to build canals and reservoirs; George Mitchell, Frank Harrison.

Lyons Irrigating Canal & Water Power Co., Lost Creek Precinct, Deuel county, Neb.; $4,500; C. H. Dolson, J. H. McHatton, J. H. Duffin; for addresses write to K. A. McCall, County Clk., Big Spring, Neb.

Columbian Colonization Co., Springfield, Ill.; $4,000,-

000; to irrigate and colonize a large tract of government land north of San Bernardino mountains in San Bernardino county, Cal.; J. W. Wilson, Howard & Wilson Pub. Co.; H. P. Sweet, Los Angeles, Cal.; J. G. Foster, London, Eng.

San Benito Irrigation Co., San Francisco, Cal.; $500,000; commenced with $206,000; to build ditches, pipe lines and water-works; C. H. Walker, N. H. Eastland, W. T. Halliday, Oakland; H. W. Westphal, Leander Shores, San Francisco.

SEWERS.

NORWAY, ME.—The question of constructing a system and improving the streets is being discussed.

BELMONT, MASS.—The citizens have voted to construct a sewer at Hills Crossing and to issue bonds for that purpose.——E. A. W. Hammatt, Engr., 5 Pemberton Square, Boston, has prepared plans for 2.6 miles of 15 to 10-in. pipe sewers, estimated to cost $24,000. W. L. Chenery, Town Clk.

BOSTON, MASS.—The city engineer has furnished estimates for making surveys and plans for draining the Charles River watershed, in West Roxbury. The district comprises that part of West Roxbury which drains naturally into the Charles River. The total cost, including 51,239 ft. of sewer, from Central Ave. to Weld St.; 4,200 ft. (Germantown branch); land damages; engineering and contingencies, and 11½ miles of street sewers, would be $634,712.

SEA CLIFF, N. Y.—The improvement association has appointed a committee, consisting of D. W. Pardee, C. S. Chellborg, F. C. Cole and E. H. Speed, to confer with an engineer with a view to making plans for a system.

NEWARK, N. J.—A meeting of the board of public works and board of health is to be held soon to discuss the question of constructing sewers in about 75 miles of streets. The city has 197 miles of streets, 125 miles of which have sewers.

DU BOIS, PA.—The council has voted to issue $7,500 of 5% bonds for sewer purposes.

DUNMORE, PA.—Gordon & Co., Scranton, have been awarded the contract for constructing a sewer in Ward 6 at $1.50 per ft.

GEORGETOWN, D. C.—The question of constructing sewers in Tenleytown is being discussed.

OPELIKA, ALA.—The legislature is to be petitioned for authority to issue $25,000 in bonds for sewers, according to reports.

KNOXVILLE, TENN.—W. E. Moses, Recdr., North Knoxville, writes us that a preliminary survey and estimate has been completed for a system in North Knoxville and will be submitted to the commission at once and by it reported to the council as soon as practicable. Engr., W. B. Crenshan, Knoxville.

ADA, O.—The contract for the Ada county sewer has been awarded to Thos. S. Wight, Defiance, at $6,850; engineer's estimate, $7,720. The sewer will be 11,770 ft. in length, of which 5,280 ft. is a 24-in. pipe outfall, average cut, 7½ ft. The work is to be completed Jan 10. Engr., W. E. Myers.

GALLIPOLIS, O.—S. M. Gray, Providence, R. I., has been engaged to prepare plans for a system.

YOUNGSTOWN, O.—The council is discussing a proposition for building a sewer in Oak St., estimated to cost $15,000, to give work to the unemployed.

DES PLAINES, ILL.—The council has passed an ordinance for a 36-in. brick outlet sewer in Miner St.

MACOMB, ILL.—A committee has been appointed to confer with the commissioners of McDonough county for constructing a sewer 4,000 ft. in length jointly with the county, at an estimated cost of $5,000.

OAK PARK, ILL.—The council has voted to construct the Ogden Ave. sewer system, which will be built of pipe and brick, and will have laterals in eight or more streets.

OCONOMOWOC, WIS.—W. A. Parker is preparing plans for a system. Consult. Engr., W. S. Shields, Title & Trust Bldg., Chicago. The city clerk writes us that before construction can commence an election will have to be held to vote on the proposition to issue bonds.

KEOKUK, IA.—The engineer has been directed to prepare plans and specifications for an extension of the main sewer to the river.

ST. LOUIS, MO.—An ordinance has been adopted for constructing a sewer in district No. 3, estimated to cost $34,500.

SANTA ANA, CAL.—The chamber of commerce is discussing the sewerage question.

SALT LAKE CITY, UTAH.—The city engineer reports that the gravity sewer has been completed up to the old court house corner, and no more work will be done this year. From this point to State and Fifth South Sts., a distance of over 6,000 ft., the sewer will be constructed next year, work commencing in the spring. The cost of completing the sewer will be about $150,000.

SUDBURY, ONT.—Bids are asked until Dec. 29 for the purchase of $10,000 of sewerage and electric light bonds. Arthur Ferris, Town Clk.

STREETS.

BROOKLYN, N. Y.—The aldermen have voted to pave portions of Kingsland and Rogers Aves. and Essex St. with Belgian blocks, estimated to cost $53,500; and Barbey, McDonough and Hooper Sts. with asphalt, estimated to cost $28,500.

NEW YORK, N. Y.—Bids are asked by the department of public works until Dec. 28 for grading portions of four streets.

NIAGARA FALLS, N. Y.—The board of public works has recommended to the council that steps be taken to pave Falls St. from Riverway to Third St., and Main St. from Falls St. to the river. Main St. is to be paved with brick from the New York Central & Hudson River R. R. tracks to Linwood Ave.

JERSEY CITY, N. J.—Plans have been made for extending 13th St. from Coles St. to the hill, estimated to cost $60,000. The road will be 76 ft. 10 ins. above Coles St., the grade being 4%. John Casey and A. J. Corcoran are interested, and the plans can be seen at the former's store on Grove St.

FOSTORIA, O.—The Standard Construction Co. has been awarded the contract for paving a portion of Tiffin St. with Parto blocks.

CINCINNATI, O.—Bids are asked by the board of administration until Jan. 9 for paving a portion of Rankin St. with brick.

CLEVELAND, O.—It is stated that the following paving is to be done next year: 19 streets with dressed block pavements, 38,243 ft. in length, and containing 128,783 sq. yds.; six streets with common Medina stone, 15,737 lin. ft., 55,927 sq. yds.; 19 with brick, 27,605 lin. ft., 87,462 sq. yds.; one with asphalt, 475 lin. ft., 3,459 sq. yds. The total improvements amount to 82,060 lin. ft., or 275,631 sq. yds.

FRANKFORT, IND.—The council proposes to pave five streets and several alleys next year with brick, asphalt or other material.

PEORIA, ILL.—It is proposed to pave portions of six streets, at an estimated cost of about $190,892. F. E. Lukens, Clk.

ST. PAUL, MINN.—Bids are asked until Dec. 24 for paving Third St. with granite blocks on concrete, or with asphalt. J. C. Mueller, Clk. Bd. Pub. Wks.

KANSAS CITY, MO.—The board of public works has approved ordinances for paving Forest Ave. with Trinidad Lake asphalt and Oak St. with brick.

OKLAHOMA CITY, OKLA.—It is reported that arrangements are being made to construct asphaltum pavements.

ELECTRIC LIGHT AND POWER.

BETHEL, ME.—It is reported that the question of lighting this place, Gilead and West Bethel, Me., and Shelburne, N. H., with electricity from Gorham is being discussed.

MANNSVILLE, N. Y.—G. W. Goodridge is reported as making arrangements to put in an electric light plant. The citizens have subscribed for over 200 lights.

SYRACUSE, N. Y.—The question of the city owning the electric light plant is being discussed and a meeting to consider the subject will soon be held by the business men's association.

BROWNSVILLE, TENN.—It is reported that a franchise has been granted to J. R. Bond, John Clinton and J. A. Brewer for an electric light plant.

HENDERSON, KY.—The council has voted to put in an electric light plant. A. B. Hart, Chn. Com.

EAST PALESTINE, O.—G. E. Seabring and F. A. Seabring, East Liverpool, have been granted a 5-year franchise for lighting this place with electricity. John Archibald, Town Clk.

LOWELLVILLE, O.—The citizens are reported as soon to vote on the question of constructing an electric light plant for public and private lighting. J. S. Roller is village solicitor.

NEWBERRY, MICH.—Press reports state that heretofore the water for the village has been pumped by a local furnace company under contract. This contract has expired and it has not been renewed, and now a number of citizens have made an offer to the council to organize a company and pump the village water and put in and operate an electric light plant for $2,500, provided they are given a five-year contract. The price for the pumping alone under the old contract was $1,800 per year.

RICHMOND, MICH.—It is reported that a party has offered to light this village by electricity, putting in its own plant, for a little more than is now being paid for oil lamps.

ROMEO, MICH.—The project of lighting the streets by electricity is being discussed.

QUINCY, ILL.—A new electric light company has been organized by J. P. Wheeler, H. O. Cannon and J. L. Fawcett.

ROCKFORD, ILL.—It is reported that this place will have its own electric light plant.

WARREN, ILL.—The question of lighting this place by electricity is being discussed.

CEDARBURG, WIS.—J. W. Raeder has petitioned the council for a franchise to put in an electric light plant. The council will consider the petition Dec. 28.

OSKALOOSA, IA.—It is reported that the electric light plant at this place has been destroyed by fire; loss, $30,000.

CHILLICOTHE, MO.—It is reported that the plant of the Chillicothe Water & Light Co. will be improved at a cost of $10,000 to $12,000. The work will include the latest electric machinery and at least 1,000 additional lights.

WEBB CITY, MO.—The council has directed the ordinance committee to prepare an ordinance authorizing an election to vote on the question of issuing $15,000 in bonds for an electric light plant.

SILOAM SPRINGS, ARK.—A company has secured a franchise for electric lights and water-works. The lights, it is reported, will be in operation by Mar. 1.

NEW WHATCOM, WASH.—A proposition is being discussed to issue $15,000 in bonds for a water power plant to supply the city with electricity.

PARRSBORO, N. S.—The legislature has been petitioned for a charter to incorporate an electric light and power company, with a capital stock of $10,000.

SUDBURY, ONT.—Bids are asked until Dec. 29 for the purchase of $10,000 in electric light and sewer bonds. Arthur Ferris, Town Clk.

NEW COMPANIES.—People's Electric Co., Terre Haute, Ind.; $100,000; Andrew J. Crawford.

Denison Electric Light & Power Co., Denison, Ia.; $20,000.

Berrien Springs Water Power Co., Berrien Springs, Mich.; $50,000; G. H. Murdock, R. D. Dix.

Shore Electric Co., Red Bank, N. J.; $100,000; F. W. Ward, East Orange; Harry Chandler, Newark; Percy Ingalls, Verona.

Suburban Light, Heat & Power Co., Pittsburg, Pa.; $5,000; S. P. Conner, J. W. Patterson, T. A. Noble, Pittsburg; J. F. Saltz, Mount Oliver.

Niagara Engineering Co., Buffalo, N. Y.; $10,000; to construct electric light, railways and power plants; L. Bradley, Dow Clifton, C. W. Nobles.

Tremont Improvement Co., Portland; $1,000; to build electric plants and supplies for street railways. Pres., E. F. Thompson; Treas., W. G. Chapman.

Phoenix Electric Supply Co., Warren., O.; $1,000; to manufacture electric lamps, supplies, and furnishing light and power; W. B. Swager, W. F. Corbin, H. M. Miller.

Douglas Light & Power Co., Douglas, Wyo.; $60,000; to build canals along the North Platte River in Converse county for developing water power; G. H. Cross, A. M. Crafts.

Quinze Electric Co., Ottawa, Ont.; $80,000; to build electric railway and supply electricity and power in Pontiac county; James B. Klock; R. A. Klock and J. T. McDougall.

GARBAGE DISPOSAL.

BRIDGEPORT, CONN.—The board of health has voted to appoint a committee to visit other cities to investigate the question of garbage disposal.

NEW YORK, N. Y.—The American Reduction Co. was incorporated Dec. 15 to treat garbage and all substances containing nitrogen, to extract grease therefrom and to manufacture fertilizer, according to press reports; capital stock, $100,000; directors, N. B. Powter, S. M. Roosevelt and Edward Keely, of New York, and John B. Campbell, of Brooklyn.

CAMDEN, N. J.—Bids are asked until Dec. 26 for the erection of a garbage crematory of a daily capacity of 60 tons, the same to be erected on city property on Federal St. near the creek. Address J. B. Fox, Chn. Com.; B. H. Shivers, Clk. Com.; L. E. Farnham, Cy. Engr.

ALLEGHENY, PA.—The council is considering an ordinance for the location of a new garbage furnace.

PHILADELPHIA, PA.—The Portable Electrical & Steam Garbage Reduction Co. was incorporated in New Jersey, Dec. 17, to manufacture, lease or sell apparatus for destroying or desiccating waste matter of all kinds; capital stock, $100,000, commencing with $20,000; incorporators, Francis Dougherty, J. H. Clarke, Oscar D. McClellan, of Philadelphia, and Joseph Franklin, of Camden, N. J.

ST. PAUL, MINN.—The board of aldermen has rejected all the bids for garbage crematories, as recently advertised, and has voted to ask for new bids for garbage disposal according to the present specifications, the contract to be for one year. The bids were as follows: Thos. Manning, $54,540 for two Dixon crematories, or $54,620 for two Thackeray crematories; Preston & Kriegher, $59,000, or $63,000, respectively.

DENVER, COLO.—A resolution has been introduced in the board of aldermen directing that bids be asked for removing the garbage of the city. It was stated that the present cost of this is $9,840 per year and that if bids are called for the work would be done free of charge for the use of the garbage to feed hogs.

MISCELLANEOUS CONTRACTS AND SUPPLIES.

CITY HALL.—Monett, Mo.—Lee Matthews has prepared plans for a new city hall and jail, according to reports.

CEMENT.—Halifax, N. S.—Bids are asked until Jan. 8 for 4,000 bbls. Portland cement. F. W. W. Doane, Cy. Engr.

CITY HALL.—Davenport, Ia.—Bids are asked until Dec. 27 for the construction of a city hall. Arch., J. W. Ross. E. W. Boynton, Comr.

ELEVATORS.—Minneapolis, Minn.—The city hall and court house commissions have rejected all the bids received Dec. 4 for elevators.

FIRE HOSE.—Buffalo, N. Y.—Bids are asked by the fire commissioners until Dec. 28 for 10,000 ft. of 2½-in. solid-woven cotton rubber-lined fire hose.

WATER TOWERS.—New York, N. Y.—Bids are asked by the fire department until Dec. 26 and 28 for furnishing a water tower, one at each date.

COURT HOUSE.—Rochester, Ind.—It is reported that the county commissioner will commence the construction of a $75,000-court house early next spring.

ROCK TUNNEL.—Boonton, N. J.—Bids are asked until Dec. 29 for excavating 1,500 ft. of rock tunnel, as stated in our advertising columns. Address C. P. Bassett, Summit, N. J.

MANUFACTURING PLANTS.—Findlay, O.—A correspondent writes us that this city is now offering location and buildings to parties starting acceptable manufacturing plants in the city.

REMOVING SHOALS.—Burlington, Vt.—Bids are asked until Jan. 17 for the removal of shoals in St. Lawrence River, as stated in our advertising columns. Capt. Smith S. Leach, U. S. Engr. Office.

PLANS FOR COURT HOUSE AND JAIL.—St. Joseph, Mich.—Architects are invited to submit plans until Dec. 27 for a new court house, sheriff's residence and jail, to cost $55,000. Fred A. Woodruff, County Clk.

HIRE OF DREDGE AND SNAG BOAT.—New Orleans, La.—Bids are asked until Jan. 10 for hire of dredge for improving Bayou Teche, La., and for hire of snag boat for improving Sabine River, Tex. Maj. Jas. B. Quinn, U. S. Engr. Office.

ELECTRIC WIRE CONDUITS, ETC.—Rockford, Ill.—Bids are asked until Jan. 8 for the interior finish, plumbing, conduits for electric wires, etc., for the U. S. public building in this city, as stated in our advertising columns. Address C. E. Kemper, Acting Supervising Arch., Washington, D. C.

GAS AND ELECTRIC LIGHT FIXTURES.—Washington, D. C.—Bids are asked until Jan. 3 for furnishing and placing in position the combination gas and electric light fixtures in the U. S. public buildings at Cedar Rapids, Ia., Fort Dodge, Ia., Lowell, Mass., Sheboygan, Wis., and Sioux Falls, S. Dak. C. S. Hamlin, Acting Secy., Treasury Dept.

NATURAL GAS.—Findlay, O.—C. A. Stockton, Pres. Natural Gas Dept., writes us that anticipating a shortage in the supply of natural gas, which is now being used for fuel and lighting in this city, one or two gas manufacturing companies are trying to secure a franchise. Many of the citizens think this should not be granted unless the present natural gas plant is absorbed.

DREDGING.—Wilmington, Del.—Bids are asked until Jan. 8 for dredging and excavating upon the route of the inland waterway from Chincoteague Bay to Delaware Bay, as stated in our advertising columns. Wm. F. Smith, U. S. Agt.

New York, N. Y.—Bids are asked by the depart-

ment of docks until Jan. 3 for 200,000 cu. yds. of mud dredging in the North River.

BUILDINGS.—Niagara Falls, N. Y.—August Esenwein, Arch., Buffalo, has about completed plans and specifications for a $40,000 addition to the Hotel International. Next week he will ask for bids. The contract will call for considerable steel work.

Buffalo, N. Y.—M. H. Birge & Sons, owners of the big wallpaper plant gutted by fire Dec. 10, are conferring with August Esenwein, Arch., with a view to rebuilding immediately. They intend to erect a large brick structure, possibly of steel construction.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work.	Place.	See Eng. News.
Dec. 21.	Dredging, St. Augustine, Fla. Advertised, Eng. News, Nov. 22 to Dec. 13.		Nov. 29
Dec. 21.	Sewer, Brooklyn, N. Y.		Dec. 13
Dec. 21.	Fire Engines, etc.,	Philadelphia, Pa.	Dec. 13
Dec. 21.	Repairing boilers,	Chicago, Ill.	Dec. 13
Dec. 21.	Brick paving,	Lima, O.	Dec. 13
Dec. 22.	Drainage ditch,	Orland, Ill.	Dec. 6
Dec. 22.	Passenger station at	Wheeling, W. Va.	Dec. 13
Dec. 22.	Bridge,	Cincinnati, O.	Dec. 13
Dec. 24.	Street imp'v't bonds,	Madisonville, O.	Nov. 29
Dec. 24.	Concrete wall, etc.,	Brooklyn navy yard.	Nov. 29
Dec. 24.	Garbage cremat'y at	Brooklyn navy yd.	Dec. 6
Dec. 24.	Bridge superstructure,	Cincinnati, O.	Dec. 6
Dec. 24.	Stone paving,	Jersey City, N. J.	Dec. 13
Dec. 24.	Sewers,	Jersey City, N. J.	Dec. 13
Dec. 24.	Granite paving,	St. Paul, Minn.	Dec. 20
Dec. 26.	Electric lighting,	Monroe, Mich.	Nov. 15
Dec. 26.	Water tower,	New York, N. Y.	Dec. 20
Dec. 26.	Garbage crematory,	Camden, N.J.	Dec. 20
Dec. 27.	Borings,	Buffalo, N. Y.	Dec. 6
Dec. 27.	Sewer, Washington, D. C. Advertised, Eng. News, Dec. 6 to 20.		Dec. 6
Dec. 27.	Elevators,	New York, N. Y. Advertised, Eng. News, Dec. 13 and 20.	Dec. 13
Dec. 27.	Bridge,	Brookings, S. Dak.	Dec. 13
Dec. 27.	Plans for fal., etc.,	St. Joseph, Mich.	Dec. 20
Dec. 27.	City hall,	Davenport, Ia.	Dec. 20
Dec. 28.	Dredging, Rock Island, Ill. Advertised, Eng. News, Dec. 6 to 27.		Dec. 6
Dec. 28.	Stone and br'k w'k at	Kansas City, Mo. Advertised, Eng. News, Dec. 6 and 13.	Dec. 6
Dec. 28.	Fire hose,	Buffalo, N. Y.	Dec. 20
Dec. 28.	Water tower,	New York, N. Y.	Dec. 20
Dec. 28.	Grad'ng,	New York, N. Y.	Dec. 20
Dec. 28.	Bridge masonry,	Philadelphia, Pa.	Dec. 20
Dec. 28.	Iron truss bridge,	Circleville, O.	Dec. 20
Dec. 28.	Water tube boilers,	St. Louis, Mo.	Dec. 20
Dec. 28.	Water-works system,	Meadford, Ont.	Dec. 20
Dec. 29.	Sewer system, Fortress Monroe, Va. Advertised, Eng. News, Dec. 6 to 27.		Dec. 6
Dec. 29.	Water bonds ($30,000),	Sudbury, Ont.	Dec. 20
Dec. 29.	Rock tunnel,	Bronton, N. J. Advertised, Eng. News, Dec. 20 and 27.	Dec. 20
Dec. 29.	Electric light bonds,	Sudbury, Ont.	Dec. 20
Dec. 31.	Hire of dredging plant, Advertised, Eng. News, Nov. 29 to Dec. 20.	Buffalo, N. Y.	Dec. 6
Jan. 1.	Pumping engine,	Madison, Ind.	Dec. 20
Jan. 2.	U. S. building at Advertised, Eng. News, Dec. 13 and 20.	Atlanta, Ga.	Dec. 13
Jan. 3.	Dredging (200,000 cu.yds.),	New York.	Dec. 20
Jan. 3.	Gas and el.lt. fixtrs (5bldgs),	Washington.	Dec. 20
Jan. 4.	Breakwater,	San Francisco, Cal.	Dec. 13
Jan. 5.	Pine timber,	St. Louis, Mo.	Dec. 13
Jan. 7.	Cement, stone, etc., Advertised, Eng. News, Dec. 6 to 27.	Wilmington, N. C.	Dec. 6
Jan. 7.	Water bonds,	Detroit, Mich.	Nov. 15
Jan. 7.	Plans for city hall,	Cohoes, N. Y.	Dec. 13
Jan. 7.	Bridge,	Meridian, Miss.	Dec. 20
Jan. 7.	Bridges (6),	Leavenworth, Kan.	Dec. 20
Jan. 7.	Bridge,	Toledo, O.	Dec. 20
Jan. 8.	Bridge plans,	Buffalo, N. Y.	Dec. 13
Jan. 8.	Dredging and excav., Advertised, Eng. News, Dec. 20 to Jan. 3.	Wilm'ngton, Del.	Dec. 20
Jan. 8.	Interior finish, etc., Advert'sed, Eng. News, Dec. 20 and 27.	Rockford, Ill.	Dec. 20
Jan. 8.	Cement,	Halifax, N. S.	Dec. 20
Jan. 9.	Brick paving,	Cincinnati, O.	Dec. 20
Jan. 10.	Water-works system, Advertised, Eng. News, Dec. 20 to Jan. 3.	Astoria, Ore.	Dec. 13
Jan. 10.	Hire dredge and snag boat,	New Orleans.	Dec. 20
Jan. 10.	Water bonds ($200,000),	Astoria, Ore.	Dec. 20
Jan. 12.	Hotel building,	Medford, Wis.	Dec. 13
Jan. 17.	Removing shoals, Advertised, Eng. News, Dec. 20 to Jan. 10.	Burlington, Vt.	Dec. 20
Jan. 23.	Electric light franchise,	Winnipeg, Man.	Dec. 6
Jan. 23.	Gas franchise,	Winnipeg, Man.	Dec. 6
Jan. 24.	Sale Hamilton, Ont., Bridge Co.'s plant. Advertised, Eng. News, Dec. 20 to Jan. 17.		Dec. 20
Feb. 1.	Electric lighting,	Corry, Pa.	Dec. 13
Feb. 1.	Water supply	Corry, Pa.	Dec. 13
Feb. 4.	Bridge,	Natchez, Miss.	Dec. 13
Feb. 11.	Jail,	Beaumont, Tex.	Dec. 13
Feb. 15.	Stone dam,	Holyoke, Mass. Advertised, Eng. News, Dec. 13 to Jan. 24.	Dec. 13
Feb. 19.	Tornedo boats,	Washington, D. C.	Dec. 6
No date.	Railway work,	Middletown, Conn. Advertised, Eng. News, Dec. 13 and 20.	Dec. 13

CONTRACT PRICES.

BREAKWATER EXTENSION.—Buffalo, N. Y.—The following bids were received by Maj. E. H. Ruffner, U. S. Engineer Office, Dec. 10, for extending the breakwater in Dunkirk harbor 400 ft.: J. B. Donnelly, Buffalo, 158,850 ft. of hemlock timber, $18 per M. ft.; 215,832 ft. of white pine, $28; 4,476 lbs. screw bolts, 2 cts. per lb.; 38,073 lbs. drift bolts, 3 cts.; 1,760 lbs. spikes, 4 cts.; 1,075 lbs. button-headed drift bolts, 4 cts.; 3,200 cu. yds. filling stone, $1.20 per cu. yd.; total, $13,752. Daniel W. Powell, Marquette, Mich., $17.20; $25; 2 cts., 2½ cts.; 2 cts.; $1.70; $14,501, respectively.

RETAINING WALL.—Chicago, Ill.—The drainage board has approved a contract with Mason, Hoge & King for the building of cement retaining wall in the mud pockets on sections 11, 12 and 13, at $3.50 per cu. yd.

ARTESIAN WELLS.—Chamberlain, S. Dak.—The "Journal" states that D. N. Kaufman has secured the contract from the county board for putting down two artesian wells, one in Lyon township and the other in Pleasant Grove, at $4 per ft. for 6-in. wells.

BRIDGE MASONRY.—Warren, O.—Meenice & Cunningham, Ellwood City, Pa., have commenced work on the piers and abutments for the new South St. bridge. It is stated that the work will require 1,500 perch of stone, and that the contract price is $7.35 per perch, the work to be completed by May 1.

SEWERS.—Rochester, N. Y.—Oscar H. Peacock, Engr., East Side Sewer Comr., writes us that the bids for the proposed storm water outlet sewer, noted last week, were as follows:

Bids received at Rochester, N. Y., for Outlet Sewer.

Circular brick, 5 ft. diam.

	Under Erie Canal 1,186 lin. ft.	Under Raceway (tunnel) 145 lin. ft.	In bed of River 306 lin. ft.	Rock Excav. 675 cu. yds.	Ex. Brick Masonry 10 cu. yds..	Total.
Lauer & Hagaman	$11.95	$16.30	$17.50	$1.50	$9.00	$22,994
Whitmore, Rauber & Vicinus	12.80	24.80	15.33	2.00	10.00	24,918
Thomas F. Moore	14.44	18.27	23.57	7.44	12.00	32,129
Bruff, Horn & Co.	15.60	19.89	15.60	3.00	20.00	28,384
Thomas Grady	16.51	20.05	23.75	2.75	8.75	31,699
Chambers & Casey	16.52	25.00	28.60	2.50	15.00	33.807
William Fuller	17.85	21.80	24.30	3.00	11.00	33.902
Henry L. Jones	19.50	34.00	28.00	2.50	16.00	38,473
Dwyer & Huntington	20.00	30.00	27.75	4.00	12.00	39,382
Brayer & Albaugh	20.92	25.00	24.00	3.00	16.00	37,965
H. N. Cowles	21.00	22.00	22.00	3.00	10.00	36,953

WATER-WORKS.—Monroe, N. Y.—Contracts for the proposed water-works, as advertised in Engineering News, have been awarded as follows; Engr., Alexander Potter, New York: R. D. Wood & Co., Philadelphia, 16 to 4-in. pipe, at $18.60 per ton; ordinary specials, $45; flanged specials, $65; total, $13,103; 10, 8, 6 and 4-in. valves, at $25, $15.40, $10.40 and $6.40, each, respectively; valve boxes, $2.70; 2 and 3-nozzle hydrants, at $22.25 and $25.70, respectively; total, $1,200. Neptune Meter Co., New York, 10-in. water meter, $550. E. B. Kay, Bellwood, Pa., furnishing 15-in. vitrified tile pipe, 5,600 ft., at 38¼ cts. per ft.; hauling and laying, 4½ cts. per ft.; trenching gravity line, 4 to 6 ft., 11½ cts.; 6 to 8 ft., 19 cts.; 8 to 10 ft., 30 cts.; 10 to 12 ft., 43 cts.; 12 to 14 ft., 48 cts.; 14 to 16 ft., 65 cts.; 16 to 18 ft., 78 cts.; rock excavation, $1.40 per cu. yd.; hauling and laying 16-in. cast iron pipe in lake, 240 ft., $475; brick gate house and well, $675; masonry gate house and well, $525; laying 10, 8, 6 and 4-in. pipe, 16, 15¼, 15 and 14¾ cts. per ft., respectively; total bid, $11,213. The total bids for the labor, etc., were as follows:

E. B. Kay, Bellwood, Pa.	$11,213
Donato Cuozzo, New York	13,233
W. L. Fogg, New York	13,755
A. H. Koon & Co., Kingston, Pa.	13,781
P. H. Harrison, Newark, N. J.	14,780
Acock & Son, Trenton, N. J.	15,140
D. V. Howell, Monroe, N. Y.	15,417
Cronin & O'Herron, Pittsburg, Pa.	15,529
Wild Engineering Co., Valatie, N. Y.	16,009
Ryan & Avery, Watertown, N. Y.	16,061
Pidgeon Bros., Albany, N. Y.	18,919
P. O'Herir, Chester, N. Y.	20,885
Babcock, Lary & Co., Newburg, N. Y.	21,465
J. M. McIntyre, McKeesport, Pa.	20,802
Collin & Kennedy, Carbondale, Pa.	36,024
Hedley & Christie, Newark, N. J. (upper sect.).	6,367
Smith Bros., Pelhamville, N. Y. (lower section).	8,708
Henry W. Warner, Leeds, Mass. (lower section).	10,412

The total bids for pipe and specials and for valves and hydrants were as follows:

	Pipe.	Valves & hydts.
R. D. Wood & Co., Philadelphia	$13,103	$1,200
M. J. Drummond, New York	13,214	....
McNeal Fdry. & Pipe Co., New York.	13,445	....
A. H. Coon & Co., Kingston, Pa.	13,999	1,199
P. H. Harrison, Newark, N. J.	13,200	1,262
Warren Fdry. & Mach. Co., N. Y.	13,632	....
John Fox, New York	13,654	....
Radford P. & F. Co., Radford, Va.	14,016	....
Anniston P. & F. Co., Anniston, Ala.	14,423	1,345
Henry M. Warren, New York	14,765	....
Charles Millar, Utica, N. Y.	15,129	1,207
Michigan Valve Co., Detroit	....	1,084
Kennedy Valve Co., New York	....	1,145
Ludlow Valve Co., Troy, N. Y.	....	1,176
Eddy Valve Co., Waterford, N. Y.	....	1,250
Johnson Engineering Co., New York.	....	1,420

METAL MARKET PRICES.

LEAD.—New York: 3.1 to 3.12 cts. Chicago: 2.97 cts. St. Louis: 2.8 to 2.85 cts.

NAILS.—Pittsburg: 90 cts. for wire, and 80 cts. for cut at mill, in carload lots.

BARBED WIRE.—Pittsburg: galvanized, $1.9; plain, $1.2 to $1.25 for carloads at mill.

FOUNDRY AND PIG IRON.—New York: $10 to $13. Pittsburg: $10.50 to $11.25. Chicago: $9.50 to $10.50.

TRACK MATERIAL.—New York: angle bars, 1.25 to 1.4 cts.; spikes, 1.45 to 1.6 cts.; track bolts, 1.8 to 1.9 cts. with square, and 1.9 to 2 cts. with hexagon nuts. Chicago: angle bars, 1.3 to 1.35 cts.; spikes, 1.6 to 1.7 cts.; track bolts, 1.9 to 2 cts., with hexagon nuts.

RAILS.—The rail makers in the pool have established rates for rails of 45 lbs. and over for delivery in 1895, making a considerable reduction. New York: $22 at eastern mills and $22.75 at tidewater; old rails, $11 to $12 for iron and $9 to $10 for steel; steel rails fit for relaying, $14; light rails, $20 to $22; girder rails, $24. Pittsburg: $22 for standard sections of 45 lbs. and over; old rails, $12 for iron and $9 to $11 for steel. Chicago: $25 for this year and $23 for 1895; old rails, $10.50 for iron and $7 to $9 for steel.

STRUCTURAL MATERIAL.—New York: beams, 1.3 to 1.5 cts.; channels, 1.35 to 1.5 cts.; angles, 1.2 to 1.35 cts.; tees, 1.4 to 1.6 cts.; universal mill plates, 1.2 to 1.35 cts.; steel plates, 1.25 to 1.4 cts. for tank, 1.4 to 1.45 cts. for shell, 1.5 to 1.65 cts. for flange, 1.75 to 2 cts. for ordinary firebox, 2 to 2.25 cts. for locomotive firebox. Pittsburg: beams, 1.25 to 1.3 cts.; channels, 1.25 to 1.3 cts.; angles, 1.1 to 1.2 cts.; tees, 1.35 to 1.45 cts.; universal mill plates, 1.1 to 1.2 cts.; steel plates, 1.15 to 1.25 cts. for tank, 1.3 to 1.35 cts. for shell, 1.35 to 1.4 cts. for flange, 2.5 to 3.75 for ordinary firebox, and 3.35 to 3.5 cts. for locomotive firebox. Chicago: beams, 1.45 to 1.5 cts.; channels, 1.45 to 1.5 cts.; angles, 1.35 to 1.4 cts.; tees, 1.65 cts.; universal plates, 1.35 to 1.4 cts.; steel plates, 1.35 to 1.4 cts. for tank, 1.5 to 2 cts. for flange, 2 to 4.5 cts. for firebox.

INDUSTRIAL NOTES.

THE PULLMAN PALACE CAR CO., of Chicago, Ill., has the contract for 1,000 refrigerator cars for the Armour Dressed Meat Co.

THE WESTINGHOUSE ELECTRIC & MFG. CO., of Pittsburg, Pa., has a contract for 110 motors for the West End Street Ry. Co., of Boston, Mass.

THE KING BRIDGE CO., of Cleveland, O., is reported as intending to establish branch works at Sioux City, Ia., to facilitate the handling of western orders.

THE AMERICAN ELECTRICAL WORKS, of Providence, R. I., have a large contract for wire for the electric lines of the North Chicago and West Chicago street railways.

THE MICHIGAN PENINSULAR CAR CO., of Detroit, Mich., has an order for 100 side-dump coal cars of 40 tons capacity, fitted with air brakes, for the Columbus, Hocking Valley & Toledo R. R.

THE SOUTHWARK FOUNDRY & MACHINE CO., of Philadelphia, Pa., is building a blowing engine with compound steam and compound air cylinders for pumping natural gas from wells about 40 miles distant from Pittsburg to that city.

C. E. LOSS, Pullman Building, Chicago, has been awarded the contract for building an electric railway between Marion and Anderson, Ind., a distance of 33 miles, not including switches, turnouts, etc., at $525,000, as stated in our Electric Railway items of Dec. 6. He also has the contract for building six miles of electric road at Waukesha, Wis.

THE RELIANCE GAGE CO., of Cleveland, O., states that its Reliance safety water column has been awarded the first premium of $50 by the Dixie Fair Association (which recently held the Georgia State Fair at Macon, Ga.), for the best high and low water alarms in actual operation. It is stated that experience has shown that such appliances tend to make attendants more rather than less careful.

THE HAMILTON BRIDGE WORKS, Hamilton, Ont., are to be sold, pursuant to the winding up order of the Supreme Court, and proposals will be received by J. E. O'Reilly, Master in Chancery, at Hamilton, until Jan. 24. The works are situated near the Grand Trunk Ry. station, are equipped with complete and modern machinery, and include a dock-yard and appliances for shipbuilding. The estimated capacity of the works is 5,000 tons per annum. Information may be obtained from W. Bell, liquidator, Hamilton, Ont.

THE DIAMOND OIL CO., of Columbus, O., has been organized as a combination of the Crystal Oil Co., and Sun Oil Co., of Toledo, O., the Merriam & Morgan Paraffine Co., of Cleveland, O., and other concerns. It is said that a new oil-pipe line will be laid, and a plant established at Toledo for refining and desulphurizing the Ohio oil by the Berg process. J. B. Merriam, James W. Stewart and A. M. Beckett are among the incorporators of the new company, which represents about $8,000,000 capital.

THE CHALLENGE WIND MILL & FEED MILL CO., Batavia, Ill., has enlarged the scope of its business during the past year and is now making a specialty of putting in complete water-works systems for municipalities and railways. Among other water-works plants which it has completed this year are the new supply for Batavia, Ill., estimated cost about $25,000, which includes the laying of an intake; Ackley, Ia.; Lyle, Minn., water pumped to an 80-ft. steel tower; Clarksville, Ia., 90-ft. steel tower; Parkersburg, Ia., and Strawn, Ill. Mr. Thomas Snow, Pres. and Treas., informs us that the company has several other contracts under way.

JOSEPH G. FALCON, 1110 Ayers Court, Evanston, Ill., has recently completed the 1,000-ft. 20-in. water-works intake for the Queen City Cotton Co., Burlington, Vt. Among other contracts completed by him this season were the raising of Mr. Webb's yacht in Lake Champlain, and laying the 11,880-ft. 24-in. water-works intake into that lake for the Burlington, Vt., water-works, and the 4,100-ft. 14-in. intake for the Cooperstown, N. Y., water-works. Mr. Falcon has removed his working plant, consisting of seven carloads, and again taken up his residence at Evanston, Ill., as above. He solicits correspondence with parties having any kind of submarine work on which they wish propositions.

NEW COMPANIES.—Columbus Land Co., Camden, N. J.; $50,000; John Clements and Theodore M. Reger, of Philadelphia, Pa.

Standard Mortar & Sand Co., Cincinnati, O.; $20,000; F. Lawson Moore.

Marine Iron Works, Chicago, Ill.; $40,000; Charles H. Towle, B. O. Craig and L. W. Winchester.

Municipal Water-Works Co., Portland, Me.; $200,000; Pres., T. C. Woodbury; Treas, Edmund H. York.

Windom Brick & Tile Co., Windom, Minn.; Pres., T. J. Hunter; Secy., B. W. May; Gen. Man., J. C. Goble.

Lombard Water Wheel Governor Co., Portland, Me.; $500,000; Pres., Chas. W. Holden, Boston, Mass.; Treas., H. A. Clark, Boston, Mass.

Chapin, Randolph & Co., Newark, N. J.; $100,000; wharves, docks and land reclamation works, etc.; O. T. Southworth, Jersey City, N. J.; S. A. Dutton, Brooklyn, N. Y.; A. A. Dutton, Scranton, Pa.

JUDICIAL SALE OF HAMILTON BRIDGE WORKS.

Pursuant to the winding-up order and with the approval of the Local Master at Hamilton proposals will be received by the undersigned until 3 o'clock p. m., Thursday, January 24th, 1895, for all the stock, plant, machinery, sidings and real estate belonging to the estate of the Hamilton Bridge Company (Limited), Hamilton, Canada.

The works are most favorably situated in the immediate neighborhood of the station of the Grand Trunk Railway at Hamilton with sidings running through them; the machinery is of new and the most complete description, and includes as well all the appliances for shipbuilding (for which there is also an excellent dockyard), while the works themselves and offices are admirably adapted in every way for the business and are all in first-class order, the whole offering a most exceptional opportunity to purchasers. The estimated capacity of the works is 5,000 tons per year.

The premises may be viewed and inventory seen upon application at the office of the liquidator, No. 28 James street, South Hamilton, Ont., from whom also any information regarding the works and conditions of sale may be obtained.

Offers will be opened in the public office of and in presence of the Master in Chancery at Hamilton, on Friday, January 25th, 1895, at 11 o'clock a.m.

The highest or any tender not necessarily accepted. For further information apply to

C. S. SCOTT,
Liquidator.

Or to
W. BELL, Hamilton, Canada, Liquidator's Solicitor.
J. E. O'REILLY, Local Master, Supreme Court.

51-5t

STONE DAM.

Sealed proposals will be received by the Holyoke Water Power Co., at their office in Holyoke, Mass., until noon of Feb. 15, 1895, for the construction of a stone dam, with abutments and wing walls, on the Connecticut River, in the City of Holyoke and Village of South Hadley Falls.

Summary of work.

34,500 cu. yds. rubble stone masonry.

1,825 cu. yds. granite dimension masonry in upper courses of dam.

7,000 cu. yds. granite dimension masonry in face of dam.

2,500 cu. yds. split granite masonry in back of dam.

2,300 cu. yds. granite dimension masonry in abutments and wing walls.

Forms of proposals, specifications and plans may be obtained at the office of the company. A certified check for $10,000, made payable to the Holyoke Water Power Co., must accompany each bid.

The company reserves the right to reject any or all bids.

HOLYOKE WATER POWER CO.,
50-7t By EDWARD S. WATERS, Treas.

PRESERVATION OF TIMBER.

CREOSOTE WORKS TO LET.

The Louisville & Nashville Railroad Company will lease for a term of years its complete and extensive works for creosoting timber with Dead Oil of Coal Tar, which are located on its line at its crossing of Pascagoula River, 44 miles west of Mobile.

These works are accessible to an immense supply of yellow pine timber, which may be rafted to the works at small cost, and are well known to consumers, having heretofore been leased to the late Mr. J. W. Putnam.

This is a favorable opportunity for contractors or dealers to acquire a timber preserving plant of established reputation, with good transportation facilities for export or domestic consumption.

The Company will lease these works only to parties of good reputation and credit, who will prosecute the business with enterprise and vigor.

For further particulars address

C. MARSHALL, Supt., New Orleans, La.;
or R. MONTFORT, Chief Engineer, Louisville, Ky. 50-3t

To Railroad Contractors.

8,650 ft. of railroad grading near Middletown, Conn., is ready to be let by contract. The work consists of about 6,000 cu. yds. solid rock excavation, 5,000 yds. earth excavation, 7,500 yds. embankment, and four drain pipe culverts with masonry ends. Rock work to be begun at once and finished by March 15, 1895; culverts and balance of grading to be finished by May 1, 1895. The proposed work may be inspected, and plans, profiles and specifications consulted, at any time. Further information furnished on application. Call on or address BENVENUE GRANITE QUARRIES, Middletown, Conn. 50-2t

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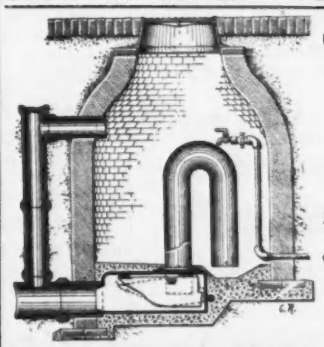

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NOTICE TO WATER-WORKS CONTRACTORS.

Sealed proposals addressed to H. G. Van Dusen, clerk, and indorsed "Proposal for Construction of Astoria Water-works," with name of party submitting bid, will be received by the Water Commission of the city of Astoria Ore., until two (2) o'clock p. m. of the 10th day of January, 1895, for the supplying of labor and materials for the construction of a complete system of waterworks involving the following items: diverting works; a gravity conduit consisting of 7½ miles of 18-in. wood stave pipe; 3 miles of 16-in. and 1 mile of 14-in. steel riveted pipe; a 6,000,000 gal. reservoir; a masonry lined tunnel 900 ft. in length; and a distributing system requiring 28,000 ft. of new pipe; 36,000 ft. of pipelaying; 91 hydrants; gates and all appurtenances necessary to make a complete system.

Plans are on file at the office of the Water Commission, and specifications and form for proposals can be obtained by application to the Clerk.

W. W. PARKER, Chairman.
H. G. VAN DUSEN, Clerk.
A. L. ADAMS and R. C. GEMMELL, Engineers.
Astoria, Ore., Dec. 4, 1894. 51-3t

ROCK TUNNEL.

NOTICE TO CONTRACTORS.

Sealed proposals for excavating 1,500 feet rock tunnel at Boonton, N. J., will be received until 4 p. m., Saturday, December 29th, 1894. Work partly completed and equipped with plant. Bond required. For particulars address

C. P. BASSETT, C. E., Summit, N. J.
51-2t

TREASURY DEPARTMENT, Office Supervising Architect, Washington, D. C., Dec. 8, 1894.—Sealed proposals will be received at this office until 2 o'clock p. m. on the 2d day of January, 1895, and opened immediately thereafter, for all the labor and material required for the erection and completion of the U. S. Government Building, Cotton States and International Exposition, Atlanta, Georgia, in accordance with drawings and specification, copies of which may be had at this office, or the office of the Superintendent at Atlanta, Georgia. Each bid must be accompanied by a certified check for a sum not less than two per cent. of the proposal. The right is reserved to reject any or all bids, and to waive any defect or informality in any bid, should it be deemed in the interest of the Government to do so. All proposals received after the time stated will be returned to the bidders. Proposals must be inclosed in envelopes, sealed and marked "Proposal for U. S. Government Building, Cotton States and International Exposition, Atlanta, Georgia," and addressed to CHAS. E. KEMPER, Acting Supervising Architect. 50-2t

TREASURY DEPARTMENT, Office Supervising Architect, Washington, D. C., December 5, 1894.—Sealed proposals will be received at this office until 2 o'clock p. m. on the 27th day of December, 1894, and opened immediately thereafter, for all the labor and materials required to furnish and erect complete two passenger elevators in the U. S. Custom House, New York, N. Y., in accordance with drawing and specification, copies of which may be had at this office, or the office of the Superintendent of Repairs, New York, N. Y. Each bid must be accompanied by a certified check for a sum not less than 2 per cent. of the amount of the proposal. The right is reserved to reject any or all bids and to waive any defect or informality in any bid should it be deemed in the interest of the Government to do so. All bids received after the time stated will be returned to the bidders. Proposals must be inclosed in envelopes, sealed and marked "Proposal for Two Passenger Elevators for the U. S. Custom House at New York, N. Y.," and addressed to CHARLES E. KEMPER, Acting Supervising Architect. 50-2t

TREASURY DEPARTMENT, Office Supervising Architect, Washington, D. C., December 12, 1894.—Sealed proposals will be received at this office until 2 o'clock p. m. on the 8th day of January, 1895, and opened immediately thereafter, for all the labor and materials required for the interior finish, plumbing, conduits for electric wires, etc., for the U. S. Post Office building at Rockford, Illinois, in accordance with the drawings and specification, copies of which may be had at this office, or the office of the Superintendent at Rockford, Illinois. Each bid must be accompanied by a certified check for a sum not less than 2 per cent. of the amount of the proposal. The right is reserved to reject any or all bids and to waive any defect or informality in any bid should it be deemed in the interest of the Government to do so. All proposals received after the time stated will be returned to the bidders. Proposals must be inclosed in envelopes, sealed and marked "Proposal for the Interior Finish, Plumbing, Etc., for the U. S. Post Office Building at Rockford, Ill.," and addressed to C. E. KEMPER, Acting Supervising Architect. 51-2t

U. S ENGINEER OFFICE, BURLINGTON, Vt., Dec. 17, 1894.—Sealed proposals in triplicate, for the removal of shoals near Crossover Light, Saint Lawrence River, N. Y., will be received here until 2 p. m., Jan. 17, 1895, and then publicly opened. Full information furnished on application. SMITH S. LEACH, Capt. Engrs. 51-4t

For Other Proposals See Page XVa.

PROPOSALS FOR THE CONSTRUCTION of a Sewer.—Office of the Commissioners D. C., Washington, D. C., Dec. 4, 1894.—Sealed proposals will be received at this office until 11 a. m., Dec. 27, 1894, for constructing a sewer in Rock Creek Valley, from near Woodley Road to Piney Branch. Specifications and blank forms of proposals may be obtained at this office. J. W. ROSS, GEORGE TRUESDELL, CHAS. F. POWELL, Commissioners D. C.
49-3t

PROPOSALS FOR DREDGING IN Quincy Bay, Ill. U. S Engineer Office, Rock Island, Ill., Nov. 28, 1894. Sealed proposals will be received here until 2 p. m., Dec. 28, 1894, and then publicly opened, for dredging in Quincy Bay, Ill. All information furnished on application. A. MACKENZIE, Major, Corps of Engineers. 49-4t

U. S. ENGINEER OFFICE, 601 EIGHTeenth Street, N. W., Washington, D. C., Nov. 28, 1894. Sealed proposals for the construction of a sewerage system at Fort Monroe, Va., will be received here until 12 m., Saturday, Dec. 29, 1894, and then publicly opened. All information furnished on application. CHAS. E. L. B. DAVIS, Major, Engrs. 49-4t

U. S. ENGINEER OFFICE, 121 FRANKLIN Street, Buffalo, N. Y., Nov. 30, 1894.—Sealed proposals for hire of dredging plant on improvement of Tonawanda Harbor and Niagara River, New York, will be received here until 2 p. m., Dec. 31, 1894, and then publicly opened. Information furnished on application to Major E. H. RUFFNER, Engrs. 48-4t

U. S. ENGINEER OFFICE, WILMINGton, N. C., Dec. 5, 1894.—Sealed proposals will be received here until 12 o'clock, noon, Jan. 7, 1895, for furnishing and delivering at Fort Caswell, N. C., cement, broken stone, rubble stone and sand for concrete masonry. All information furnished on application. W. S. STANTON, Major Engrs. 50-4t

U. S. ENGINEER OFFICE, WILMINGton, Del., December 8th, 1894.—Sealed proposals, in triplicate, for dredging and excavating upon the route of the inland waterway from Chincoteague Bay, Va., to Delaware Bay, Del., will be received here until 12 o'clock noon, January 8th, 1895, and then publicly opened. All information furnished on application to WM. F. SMITH, U. S. Agent. 51-3t

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